

THE
MILITARY ENGINEER:
OR,
A TREATISE
ON THE
ATTACK and DEFENCE
Of all Kinds of
FORTIFIED PLACES.

In which are explained the construction of the necessary works, with the method of designing them on paper, and transferring the plan to the ground; the attacks of large towns, with their different outworks most in use; and also of smaller places, forts and other posts, which occur in the course of a war; the manner of escalades and surprizes; and all other matters relating either to the works or operations, necessary to convey a full knowledge of the art of engineering.

Composed by M. L E B L O N D,
PROFESSOR OF MATHEMATICS,

For the use of the French Noblesse.

To which is added,

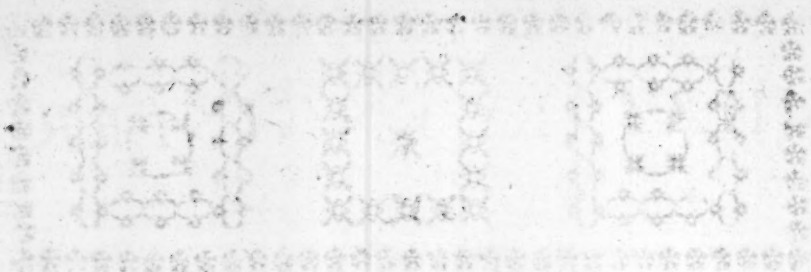
A succinct account of three remarkable SIEGES at different periods, by which the progress of the ART is pointed out.

IN TWO PARTS.

ILLUSTRATED with Twenty COPPER-PLATES.

L O N D O N,

Printed for J. NOURSE at the *Lamb* opposite *Katherine-Street* in the
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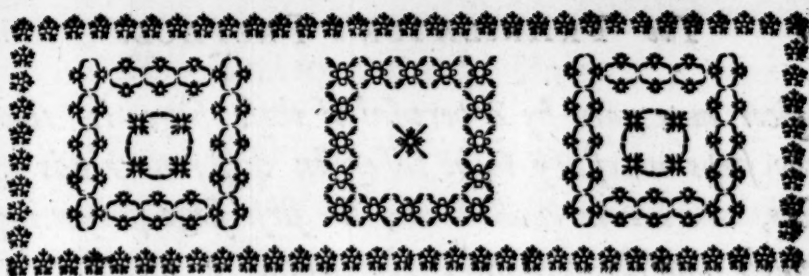
1871

THE

TRANSACTORS

PREFACE

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THE
TRANSLATOR'S
PREFACE.

TO render this work more entertaining
to the lovers of the military art, and
more useful to young officers, for
whom it was originally compiled in
French; the Editor of this English edition has
added the journals of three notable sieges, at the
distance of about half a century, in point of time,
from one another; whereby, from a proper com-
parison, the progress of the art of attacking and
defending of towns, may be partly seen, and also
the gradual advances of the works carried on by
the besiegers. Another advantage which a young
officer

officer may gain by a perusal of these sieges is, that the steps necessary to be taken in different kinds of soil, are herein illustrated; the first siege presenting much marshy ground; the second a mountainous and rocky soil; and the last good dry earth.

The siege of Bois-le-Duc, formed by the Dutch, under the command of Frederick Henry prince of Orange, lasted from the first of May 1629 to the fourteenth of September: there were five attacks, one carried on by the English and French, under the prince of Orange on the South West quarter of the town; another carried against the North East quarter by the Scotch, under the command of count Ernest Casimir of Nassau; another under the conduct of the baron de Broderode was directed against the South East side: count William of Nassau had the command of the attack on the North, and the sieur Pinsen, governor of Rees, attacked the West side. In this siege it seems as if the method of carrying on direct approaches through a morass, was first used; this method is mentioned in the following treatise of the attack of places, p. 121. Such approaches were conducted in the attacks of both count Ernest, and count William; their two approaches being joined, the attack was in conjunction carried on towards the Hintem gate, where the born-work and the ravelin between it and the town were in possession of the besiegers, when the chamade was beat at the Vucht gate; the French having also made themselves masters

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The TRANSLATOR'S PREFACE. ♥

ters of fort Isabel on the eighteenth of July, and the English of fort St. Anthony on the nineteenth, they, in conjunction, carried on the approaches towards Vucht gate; and here the breach in St. Peter's bastion was made, which brought on the capitulation, when the besieged were allowed the honours of war: the account of this siege was first published in French, in a small folio size, and printed at Leuwarden in Friezeland, 1630.

The siege of Namur in 1695, was conducted by king William the third. The whole was completely invested on the second of July, the town capitulated on the fourth of August, and the castle and other works on the hill capitulated from the first of September. The king's quarters extended from the Maese to the South East of the town, quite to the Sambre on the North West of the plate. The elector of Bavaria's quarters extended from the Sambre on the North West of the town down to the Maese on the South West; and the quarters of the Brandenburgers extended from the South East to the South West on the side of Condroz, or South side of the Maese: what is said on this subject, is a translation of a folio book printed at the Hague 1696, and entitled, Relation de la campagne de Flandre et du siege de Namur en l'annee 1695. The plates were engraved by order of king William, and the book published by his permission.

The siege of Bergen-op-Zoom in the year 1747 was formed by the French under the command of Marshal Lowendahl, the town was defended by the allies under general Cronstrom, and the lines by the allies under the prince of Saxe-Hilbourghausen. The French came against the town on the twelfth of July, and it was taken by assault on the sixteenth of September. This place having the river Scheld running on the South and South East parts, and very strong lines stretching from the North Westward through morasses, it was only to be attacked between the North East and South East parts, and the French made their approaches on the East side. The journal given in this work is something more than what was published in French in a quarto work printed at Strasbourg in the year 1750, and entitled Plans et journaux des sieges de la dernière guerre de Flandres rassemblés par deux capitaines étrangers au service de France. For a copy of a manuscript journal of the siege kept by a very considerable officer in the service of the allies, and sent over to England for the use of a great person some time since deceased, having fallen into the hands of the editor, he has blended the two journals together; and thereby, as he apprehends, has given a more distinct account of the transactions on both sides, than has before been made public. As there were a great number of mines sprung both by the assailants and defendants, they are distinguished in the plate by a small kind of circle; those sprung
by

by the French are shewn by white circles, and those fired by the allies are distinguished by shaded circles. The fortifications of this place, constructed by the great Coeborn, were esteemed a masterpiece of art; and it was believed by many proper judges, that such a defence might have been formed by the troops assembled for that purpose, as would have baffled all the efforts of the French, notwithstanding their boasted skill in the attack of places.



ERRATUM.

In the siege of Bois-le-Duc, p. 115. line last but two, read south-west.

TR EATISE

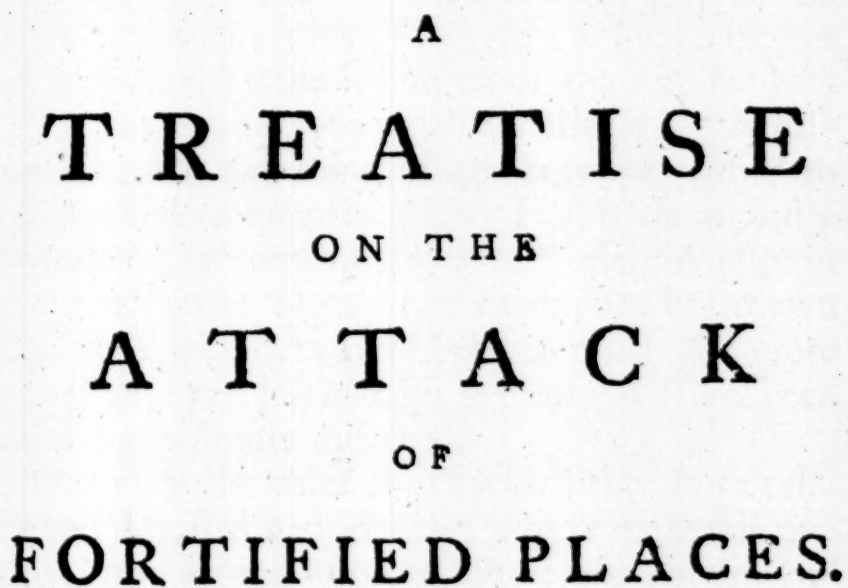
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FORTIFIED PLACES

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Marshal Vauban's excellent treatise on the attack of fortified places, seems to supersede all other works on the same subject: for as M. de Folard observes, this great man has not been excelled in this part of the military science; which he carried to such a degree of perfection by the invention of the *ricochet* batteries, and his famous parallels, that it is very difficult to add any thing of consequence, either to his method or his principles. His book is justly considered, as containing the most essential rules in the direction of sieges; and experience has shewn that these operations have been so much the more expeditious and less bloody, as those rules have been more scrupulously observed.

But since the chief object which the above celebrated Marshal had in view, was to make his method known, and to prove the necessity of following it, we have been induced to think that an elementary treatise on the same subject, pursuant to his principles, might be of some service to our military youth, and contribute to make them enter with greater ease into the spirit of this method, and render it more familiar to them.

Such was our design in undertaking this work, wherein, besides all the fundamentals laid down by Marshal Vauban, we have likewise made use of the particular practices observed in our most famous sieges, and of whatever has been published

on

A D V E R T I S E M E N T.

on the same subject by our most celebrated military writers; as M. de Feuquieres, M. de Goulon, general and engineer to the emperor, M. de Follard, &c. So that this work will be, in several respects, more complete and comprehensive than even M. Vauban's Memoirs.

Here the reader will find the particulars of every thing relating to the operations of the siege of a town fortified according to the rules of art; the method and maxims necessary for tracing the principal works on paper, and afterwards transferring them to the ground; the attack of the different out-works most in use in fortification; with whatever may be particularly requisite for the attack of small towns, castles, and other posts. Here we treat also of the surprizing of towns, and of escalades; in a word, nothing has been omitted, that is capable of conveying a proper idea and just principles, concerning the different methods to be used, in the reducing of larger as well as lesser towns; those which are regularly fortified, as well as those which have only a single wall.

The celebrated M. Vauban did not think proper to explain these different sorts of attacks in his work; but as the knowledge thereof may be of very great importance, we have collected in one view all that was necessary to be observed upon this head.

As all officers, says an able engineer (M. Rozard, who has given us a very good treatise on fortification) ought to have the ambition of attaining to the highest employments in the army, it were to be wished, for the advantage of their sovereign, that they would assiduously endeavour

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to arrive at a certain degree of knowledge of the attack, and defence of places, which would render them incomparably more deserving of the highest commands.

There are a thousand circumstances in war, wherein every officer may be obliged to attack or to defend a post. Now can there be the least room to doubt, but that he who has some tincture of this part of the military science, will acquit himself with more honour than he who has neglected it, from a notion that bravery is sufficient to accomplish all designs? Will not he find resources and expedients, which seldom occur to those who have nothing but practice to direct them? Our young gentlemen of the army cannot therefore be too much excited to this study. It is particularly with a view of serving them that I composed this work, and I hope that in the perusal thereof they will meet with nothing that shall give them the least difficulty. With a very moderate application, a young officer may be able to acquire a sufficient knowledge of the attack of fortified places, so as to reap some benefit from assisting at the approaches made during a siege; to enter into the spirit of their construction, to remark the particular incidents arising from the difference of ground and from the figure of the works; in short, to be able to conduct the like approaches himself upon any emergency. By being acquainted with the subject matter of this treatise, the operations of a siege will become more instructive and more interesting to him. Thus shall he improve much more by a single siege, than by seeing a great number without having had a previous knowledge
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of the rules observed on those occasions. For it cannot be denied but that the theory will at least excite the attention, and make an officer remark what he would otherwise have taken no notice of. Practice without doubt is an excellent master in the military art; but at the same time we may safely affirm that it wants the assistance of theory. Without this light what a number of objects would escape unobserved! Without this guide how tedious the journey to military knowledge! And how can we give the name of knowledge, to what is retained without principles, and learnt only by rote?



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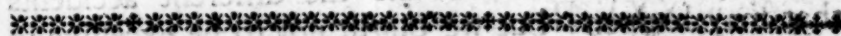
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A
TREATISE
ON THE
ATTACK
OF
FORTIFIED PLACES.



I.

*General observations on the preparations, and pre-requisites
for the attack of a place.*

* T *

HAT we may proceed with order and method in this treatise, we should imitate the conduct of architects, who, before they undertake to build a house, make an estimate, as near as possible, of the expences, and of the quantity of different materials, as well as of the time to be employed in the building; where they set before them, at one view, whatever is necessary to complete the undertaking. We should imitate, I say, this very method in the attack of fortified places, by forming an estimate of the artillery, and necessary ammunition, relatively to the strength of the place intended to be attacked, to the number of the garrison, and to the time we presume necessary to reduce it. That such an estimate cannot be absolutely exact, is obvious; yet we must agree that

an able general, well skilled in fortification and artillery, will be better qualified to give a shrewd guess; and that it is not impossible to lay down some rules upon the subject. A detail of this kind is indispensably necessary for a general, who intends to lay siege to a town, and to direct the operations himself.

It is true there are artillery-officers and engineers, to whom the general may safely commit this province: but as the undertaking concerns himself more nearly, there can be no doubt but it will be highly of service to him, to be able to enter into these particulars, to the end that he may be sure there is nothing wanting to terminate his enterprize with honour, and he does not encumber his army with too large a train of artillery, and ammunition.

It is without doubt proper to have a greater quantity of all these stores, than shall be thought absolutely necessary, in order to obviate the different accidents that may happen: but we ought not to be excessive in our precaution; neither should we carry it so far, as to render it not only useless, but burthenfome to the state. In different books we have tables of the quantity of stores that have been carried to various sieges, and we have exhibited several of them ourselves in our treatise of artillery, with a view of giving some idea of the matter to the unexperienced officer: but those tables are not exact; therefore a novice in the art of war cannot reap such benefit and instruction from them, as he would do, if they contained an explanation of the reasons, for which the several articles are used, relative to the place against which the attack is designed, and in which we suppose there is a certain quantity of artillery and number of troops, as also to the time the attack may last. We ought to calculate, at least for a month, because, according to M. Vauban, there is hardly a fortified place but may hold out a month, *when defended by intelligent men, who will do their duty*. Tables drawn up in the manner here proposed, would be of very great use to those, who by their birth and employments may

may aspire to the command of armies: but to construct them with proper exactness, would require the abilities and experience of a Vauban, or a Valiere. Theory and a slender practice are not alone sufficient means of communicating solid principles upon this subject.

Another point to be considered, would be the number of men necessary for undertaking a siege, so that the troops shall make the several approaches without being over fatigued. It is evident that there ought to be a certain proportion or relation between the besieging army, and the garrison that defends the town: but this proportion is extremely difficult to determine. Errard, one of our oldest engineers, says it ought to be as 10 to 1, that is, we should have an army of ten thousand men, to attack a town where there are a thousand in garrison: but we shall see, in giving a detail of the operations of a siege, that the above proportion, which may be good in this case, provided there is no danger of an army's marching to relieve the place, would not hold good in a town in which there were two thousand men, especially if we are also to guard against an army that should attempt to raise the siege.

In some cases this proportion may be too small; in others too large: it is evident, for instance, that there would be no occasion for an army of 200,000 men, to besiege a town that contained a garrison of 20,000. There is hardly any but the general that can determine this proportion, according to the circumstances of time and place. He ought to be so compleat a master of the art of war, as to be thoroughly acquainted with all the expedients and necessary means, for surmounting the difficulties that may be thrown in his way by the besieged. These he ought to foresee, and of course to take such precautions as shall answer all his ends, and prevent his being surpris'd by any artifice of the enemy.

The consideration of the several points here mentioned, is of very great importance. The same may be

said of the reasons which should determine the siege of one place preferable to another: but as these more particularly concern the cabinet, and the generals, we shall not examine them here. The business we have now in hand, is to instruct a young officer in the essentials of a siege, so as to enable him to trace the progress thereof, and to account for the different operations which he happens to observe.

A knowledge of this kind is absolutely necessary, to prevent his being, if I may be allowed the expression, in an unknown country, amidst the operations of the siege; and to enable him, on unforeseen occasions, to act his part like a man of understanding, and to discharge himself with honour. For which reason, we shall not enter into all the precautions a general ought to take before he forms a siege; we will suppose that he has pursued the necessary measures for securing its success; that he is acquainted with the enemy's strength; and that he has a superior army, which shall enable him to undertake the siege, without being apprehensive that the enemy will oblige him to raise it.

An army that lays siege to a town, must of course weaken itself very much; for part of it becomes necessary in order to construct, and guard the works. Should the enemy have an army of equal force to the besiegers, this would soon render the former superior, because they may attack the latter with their whole force; whereas the besiegers could not employ all theirs. Hence a siege is seldom resolved upon, but when a general presumes he is able to continue it, and to oppose the enemy with such a force as shall prevent their attempting to disturb his operations.

We shall suppose also, that the general has taken care to collect in the neighbouring towns, the quantity of stores which he thinks he shall want; and that he is able to convey them with safety before the town which he has resolved to besiege; that he has neglected nothing capable of putting the enemy upon a wrong scent; or, in other terms, nothing that is likely to keep them

them in the dark concerning the place he intends to besiege, and make them imagine he has a design upon some other, to the end that they may withdraw part of their troops and ammunition from this place; or at least that he may hinder them from throwing fresh succours and ammunition into the town, which would increase the difficulty of the operations, consequently would lengthen out the siege, and render it more bloody: in short, that the secret has been most carefully observed. All this being supposed, we shall proceed immediately to particulars, after we have first defined or explained the chief terms that are used in treating of this part of the art of war.



II.

Definitions or explications of the terms generally used in treating of sieges.

WE give the name of *army* to a great number of military men united under the command of one chief. Sometimes we make use of the word *troops*, to signify an army.

An army is composed of *infantry* and *cavalry*; the former fight on foot, and the latter on horseback.

The infantry is divided into different corps or parties of about six hundred men: each of those corps is called a *battalion*.

In like manner the cavalry is divided into different corps or parties of about one hundred and twenty, or one hundred and fifty men, which are called *squadrons*.

An army consists of battalions and squadrons.

Battalions, squadrons, and in general all bodies of soldiers arrayed for battle, or for any other military service, form *ranks* and *files*.

Rank, is a number of soldiers placed side by side in a direct line; and file is a number of soldiers placed one before another, forming likewise a direct line.

Ranks in each corps or body of troops are equal; and files are composed of as many men as there are ranks.

The number of ranks, or the number of soldiers of each file in a battalion, or in a squadron, is called the *depth* of the battalion or squadron.

The depth of a battalion is generally of four men, and that of a squadron three.

Therefore if the battalion consists of six hundred men, each rank will be of a hundred and fifty; and if the squadron is of a hundred and fifty, the ranks will be each of fifty men.

The first rank is called the *head of the battalion*, and of the squadron; the last the *rear*; and the two files which terminate to the right and left, are called *wings*.

Neither the battalions nor squadrons are placed close to each other; but between them is left a space nearly equal to that which they occupy, and which serves as an opening for another battalion or squadron to pass through.

The army is likewise divided into bodies, to which we give the name of *regiments*.

There are regiments of infantry, cavalry, and *dragoons*; the latter are a particular corps who fight on foot as well as on horseback. They are subdivided into companies; and there are four of these in a squadron.

Regiments are not all composed of the same number of men; there are some of one battalion, others of two battalions, &c. and among the cavalry, some of two squadrons, others of three, &c.

The person who has the command of a regiment, is called *colonel* among the infantry; *mestre de camp* among the cavalry*.

In regard to companies, those who have the command of them in subordination to a colonel, are called *captains* among the infantry, as well as the cavalry.

* This distinction obtains in France and Spain; but in England they are all indifferently called *colonels*.

Beside the captains, there are other officers at the head of companies, who command them in the absence of the captain, to whom they are subordinate: but we shall not treat of them here, as it is not our design to give a list of all those that have the command of each body of troops, and who go by the general name of officers; we shall only mention a word of those officers whose degree is above a colonel.

The post of a *brigadier* is the first military preferment that a colonel is advanced to.

There are brigadiers of foot, horse, and dragoons.

The duty of a brigadier is to command a body of several regiments, which is called a *brigade*. Brigades of foot commonly consist of four or five, and even of six battalions.

Brigades of horse consist of eight or ten squadrons.

Brigadiers of foot have the command of foot brigades; those of horse command horse brigades, &c.

Brigadiers have successively, and in their turn, a day of duty in the army; this consists in assisting the general officers that rank above them, in every thing that relates to the arrangement and security of the camp occupied by the army, and in executing the different orders which they may receive for this purpose. A brigadier is not a general officer; he is nominated to command his own brigade, and not any other particular corps in the army.

Next above a brigadier is the *marechal de camp*, who has the name of general officer, because he is not considered as belonging to any particular corps, but may command all the different bodies of the army. The principal functions of the *marechal de camp*, are to take care of the encampments of the army, to give directions himself to the officers charged with the particulars of that province, in every thing that appeareth necessary to him, either with regard to the ground it should occupy, or to its security, or to prevent the army from being attacked to a disadvantage. He likewise has the distributing of the troops designed to guard the camp,

in such places as shall seem most proper to him, to the end that these troops may easily discover the enemy from the several posts where they are placed, and run no danger of being cut off. He frequently happens to have a particular command of different bodies of troops entrusted to his care; and in time of battle he assists the lieutenant generals in their command. The *marechals de camp* in an army have each their day of duty successively, and in their turn.

Superior immediately to a *marechal de camp* is the lieutenant general. This officer has oftentimes the command of several corps of an army, and is subordinate to none but to marshals of France, or to the oldest lieutenant general, when there is never a marshal of France in the army. The lieutenant generals have each their day of duty, like the *marechals de camp*, and the brigadiers.

The highest military degree at present is that of marshal of France. Heretofore they were subordinate to the constable, being his lieutenants, but now they are subject to no officer of a higher degree; their business is to command in chief.

A body of troops, or of an army, shut up in a place, with a view to guard and defend it, is called the *garrison*; which is composed of horse or dragoons, and foot.

To lay siege to a place, is to attack it with an army which shall enclose the enemy on all sides, and oblige them to surrender the place, either by demolishing the fortifications, or by reducing the garrison, so that there shall not remain a sufficient number to defend it.

To blockade a place, is to surround it with different bodies of troops, so as to stop up the avenues to it on all sides, and to prevent any thing from either entering or going out of the place.

The intent of a *blockade* is to oblige those who are shut up in a town to consume all their provisions, when they must necessarily surrender for want of subsistence.

Hence

Hence it is obvious, that a blockade must last a long time, when a town is well supplied with provisions; therefore a resolution of taking it by this method is seldom entered upon, except when a general has very good intelligence that the magazines are empty; or when the nature and situation of the place will not permit the approaches, so as to attack it in the usual form.

To invest a place, is to surround it with troops on all sides, as in a blockade, disposed in such a manner, that the town shall receive no succours, either of men or provisions; and it is properly only a preparative to besiege it in form.

Sieges may be divided into several sorts, according to the nature of the towns that are to be attacked, and the method to be used by the besieging army.

The first we shall call the *siege royal*, or the real siege: which is that wherein all the different works or approaches are carried on, in order to get possession of the place, by driving the enemy successively from the several fortifications by which it is defended. This kind of siege is used only in regard to considerable towns, whose fortifications require all this apparatus, which we intend to describe in the following treatise.

A siege that does not require all the operations of a royal siege, is called an *attack*. Therefore when a body of troops are sent to make themselves masters of an important post, of a castle, or of some other small place possessed by the enemy, from whence they may be easily dislodged, we do not say that they are going to lay siege to it, but to make an attack.

To insult a work, means nothing more than to make a sudden and unsuspected attack.

To surprize a town, is to become master of it by stratagem, or some intelligence, or in such other manner as the enemy shall have no suspicion of the enterprise.

To escalate a place, is to endeavour to take it by a sudden attack, by scaling the walls or fortifications; that

that is, by mounting with ladders, and so taking possession of it, without being obliged to demolish the fortifications.

To petard a place, is to break the gate open with a petard, and by that method to try to take the town.

There is no possibility of petarding a gate, but by stealing to it sily, without being perceived by the enemy; that is, you must surprize him, before you can perform this operation.

The surprizing and scalading of towns were heretofore very common; but the present disposition of our fortifications, and the good order observed in the guarding of places, rarely permits such an enterprize with hopes of success. Yet there are cases when the attempt may be made, and is likely to succeed: of this we have a recent example in the escalade of Prague.

To bombard a town, is to throw a vast quantity of shells into it, with a view to destroy the houses and principal buildings. This operation is generally performed, when we do not expect to become masters of the place by a regular siege, and we want to mortify the prince to whom it belongs, or to chastise the inhabitants, or, in fine, to excite them to mutiny against the garrison, and thereby oblige them to surrender.

When we attempt to take a place by a sudden attack, and this place has some outworks, of which we make ourselves masters immediately, without the usual approaches, this is called *accelerating a siege*.

A line of circumvallation, consists of a parapet and a ditch, drawn round the town which we intend to besiege, when there is danger of the enemy's coming to disturb us, and to oblige us to raise the siege.

A line of countervallation, is like the line of circumvallation, and is intended to cover the besiegers against any sally from the garrison.

The ditch of circumvallation is towards the country, at the foot of the parapet; and that of countervallation is towards the town, also at the foot of the parapet.

The line of countervallation is very seldom used of late; because the new form of approaching, introduced by M. Vauban, has rendered it in a manner useless.

We likewise give the name of *line*, to works of the same nature as those we have been mentioning, behind which an army is posted, to cover an extent of country, which it could not possibly do without this sort of fortification.

When nothing more is intended than to procure a shelter against the enemy in the field, and we would throw up some fortifications to increase the difficulty of their attacking us, the works made on that occasion are called *retrenchments*. A retrenchment generally consists only of a ditch, and a parapet with its banquette. Retrenchments are likewise made with felled trees, thrown confusedly upon one another, the principal branches of which are cut sharp at the end, and pointed towards the enemy. This is an excellent kind of retrenchment. We likewise give this name to a work thrown up behind another when attacked, with a view to hold out the longer. Generally speaking, it consists only of a ditch and a parapet.

A *camp*, in general, is that space or extent of ground which an army occupies in the field, and on which the troops pitch their tents, and lodge their baggage.

During a siege, the camp is ranged all along the circumvallation, within 120 fathoms of this line; the army fronts the circumvallation, that is, the troops have this line before, and the town behind them.

The line which terminates the camp, on the side of the circumvallation, is called the *head of the camp*; and that which terminates it, on the town side, is called the *tail*, or rear of the camp.

A *quarter at a siege*, is part of the army, consisting of one or more brigades, who are under the command of a lieutenant general, or a *marechal de camp*. The quarter generally bears the name of him who commands it.

Epaulements,

Epaulements, are breast-works of earth, eight or nine feet high, to cover the cavalry from the cannon of the place.

The *biovac*, is an extraordinary guard performed every night during a siege, to prevent any succours from entering the town.

A *trench*, is a passage, with zig-zags, or turnings, which the besiegers dig in the ground, in order to approach the place, without being seen or annoyed by the enemy.

The place where the trench begins, is called the *tail of the trench*.

To open the trenches, is to begin to dig or work.

Places of arms, are parts of the trenches which encompass the whole front attacked, for the soldiers to be ready, and at hand, in order to defend the head of the works.

It is customary to make three places of arms, when the ground will permit. The first, and most distant from the place, is about three hundred fathoms from the glacis of the covert-way. The second is within 140 fathoms; and the third at the foot of the glacis.

We give the name of *boyau*, or *branch*, to those parts of the trenches which lead to the places of arms, and to the town.

Breach, is an opening made in the rampart, either by cannon or mine.

Affault, is a vigorous and sudden attack on that part of the rampart where the breach is made.

Lodgment, is a kind of trench, or retrenchment, made in a work, from which the enemy have been driven, in order to cover the troops against those parts of the fortification, which command that spot where the lodgment is intended.

There are many different kinds of materials used in sieges, the chief of which are, *fascines*, *gabions*, *sand-bags*, *wool-packs*, &c.

Fascines, are faggots, about six feet long, and eight inches in diameter, or, which amounts to the same, about

about twenty-four inches in circumference. They are bound at both ends, at the distance nearly of a foot.

Gabions, are a kind of cylindrical baskets, two feet and a half in diameter, and as many high. The manner of making them is to begin with driving eight or nine pickets or stakes circularly into the ground: these pickets ought to be three feet long, and five or six inches in circumference; they are united, like basket-work, by an intertexture of twigs, or small branches of trees. When we would make use of the gabion, it is placed in a situation opposite to that which it had during its construction, that is, the points of the pickets, which were then fastened in the ground, are turned upwards; and these points serve to fasten the fascines to the gabions.

Sand-bags, are nothing more than common bags of very coarse linen, about two feet high, and eight or ten inches in diameter; which are filled with earth, and tied very fast to prevent it from falling out.

Wool-packs, differ from sand-bags in this only, that they are much larger, and instead of earth they are filled with wool.

Besides the different things we have been speaking of, we use also in sieges, *blinds*, *chandeliers*, *mantlets*, *stuffed gabions*, *chevaux-de-frize*, *crow's feet*, and *sau-cissons*.

By *blinds*, we understand a kind of frame, made of four pieces of timber, two of which are five or six feet long, and the others two or three feet. The longest are pointed at both ends; the other two are fastened towards the ends of the former, about the distance of fifteen inches from their points. It is properly a right-angled parallelogram, the long sides of which project beyond the short ones about fifteen inches.

The *blinds*, are fixed in the trench in such a manner, that their long sides are in a vertical situation; their lower point serves to fasten them in the ground; and their upper ones to fix the fascines which are on them: they are placed along both sides of the trench, and they
are

are also put horizontally over it; the latter are then covered with fascines, so that the trench forms a covered gallery. This is not done till the work is far advanced, and where the grenades of the besiegers would greatly incommode the foldiers in the trenches.

We likewise make use of the word *blind*, to signify a kind of hurdle made of osiers, behind which the soldier carries on his work unperceived by the enemy.

Candeliers, are made of two pieces of timber, raised perpendicularly on two other horizontal pieces, upon which they are supported on both sides by braces.

The space between the two vertical pieces is filled with fascines; this machine serves likewise to cover the soldier, or the pioneer, on different occasions. The cord with which the French measure wood, is exactly like this machine.

A *mantlet*, properly so called, is a kind of screen made of several boards, placed horizontally on an axle, supported by two wheels, which the pioneer rolls before him by a pole fixed to the axis.

A *stuffed gabion*, is a large gabion filled with different materials, so that a musket-ball shall not pierce through it. It serves for the same purpose as the mantlet, to cover the pioneer in the advanced works; he rolls it before him, and he works behind it. These stuffed gabions are more in use at present than mantlets, though the latter are the better machine; probably the easy construction of the former is what gives them the preference.

Chevaux-de-frize, are large joists or beams, stuck full of wooden pins or iron spikes, to stop up any narrow pass, through which the enemy is to march.

Crows-feet, are a kind of nail with four points, disposed in such a manner as to have always three points downwards, and one upwards.

They are laid where an enemy is expected to march; and are of very great use to stop the cavalry.

A *saucisson*, is a kind of fascine much larger than ordinary: it is generally made use of in the repairing of breaches.

The

The figures of all these different machines are represented in the first plate; which, together with what has been above mentioned, will convey a sufficient idea of them. There the reader will also find the figure of the hook and fork, which are used in arranging the gabions.

The terms above explained are the most necessary for understanding this work; the others, which are any way relative to them, and which we shall use hereafter, will be defined in their proper places.

III.

Maxims or principles to be observed in the attack of places.

I.

THE approaches ought to be made, without being seen from the town, either directly, obliquely, or in flank.

EXPLICATION.

If the trenches were made advancing in a direct line towards the town, or the shortest way, the besiegers would be exposed to the fire of the enemy, posted on those parts of the fortification where the trench would terminate: if they were to be made obliquely, in order to avoid the direct fire of the place, and the whole length of the trench was seen by some other part of the fortifications, the soldiers posted in that part would reach them in flank, and the trench being thus enfiladed by the enemy, would not at all cover the troops within it, against the fire of the place.

Now as the design of the trenches is to cover the soldiers, they must therefore be directed in such a manner, as to be neither seen nor enfiladed by the enemy from any part.

II. No

II.

No more works should be made than are necessary for approaching the place without being seen, that is, the besiegers ought to carry on their approaches the shortest way possible, consistent with being covered against the enemy's fire.

III.

All the parts of the trenches should mutually support each other, and those which are farthest advanced ought not to be distant from those which are to defend them, above one hundred and twenty, or one hundred and thirty fathoms, that is, above musket-shot.

IV.

The parallels, or places of arms the most distant from the town, ought to have a greater extent than those which are nearest, that the besiegers may be able to take the enemy in flank, should they resolve to attack the nearest parallels.

V.

The trench should be opened or begun as near as possible to the place, without exposing the troops too much, in order to accelerate and diminish the operations of the siege.

EXPLICATION.

There is no such thing as giving any exact rule in regard to the distance, which ought to be observed upon opening the trenches. On level ground, this distance may be eight or nine hundred fathoms; but if there should be a hollow way in the neighbourhood of the place, the besiegers are to take advantage of it, and open the trenches nearer. In general, they are to regulate themselves upon this head according to the nature of the ground, more or less favourable to the opening the trenches.

We shall suppose, in the present work, that the opening ought to be made within eight hundred fathoms

thoms of the covert-way ; the first parallel within three hundred fathoms ; the second within a hundred and fifty ; and the third at the foot of the glacis. These are nearly the distances observed by marshal Vauban ; I say nearly, because strict exactness on this occasion is needless ; and the difference of fifteen or twenty fathoms may be considered as nothing.

VI.

Care should be taken to join the attacks, that is, they ought to have communications, to the end that they may be able to support each other.

VII.

Never to advance a work, unless it be well supported ; and for this reason, in the interval between the second and third place of arms, the besiegers should make, on both sides of the trenches, smaller places of arms, extending forty or fifty fathoms in length, parallel to the others, and constructed in the same manner, which will serve to lodge the soldiers in, who are to protect the works designed to reach *the third place of arms*.

VIII.

Observe to place the batteries of cannon in the continuations of the faces of the pieces attacked, in order to silence their fire ; and to the end that the approaches being protected, may advance with greater safety and expedition.

IX.

For this reason the besiegers should always embrace the whole front attacked, in order to have as much space as is requisite to plant the batteries on the produced faces of the works attacked.

X.

Do not begin the attack with works that lie close to one another, or with reentrant angles, which would expose the attack to the cross-fire of the enemy.

A TREATISE on the R E M A R K.

The observations above given may be considered as general maxims, which a commander ought to have ever present to his mind in the attacking of places. The disposition of the ground, and the fortifications themselves, may make it necessary to vary the figure of the works in the attack, just as the irregular circumference of a place may occasion the figure of the fortifications to vary: but let the figure of the place be of what nature it will, and let the circumjacent ground be never so singular, the besiegers must always dispose their works in such a manner, that the enemy shall not have it in their power to sally out without evident disadvantage, without being exposed to a great fire, and without exposing their flank to some part of the trenches. The batteries against the town should be also planted in such a manner, as to be able to silence the fire of the besieged.

We shall proceed in the present work according to the method observed in our *Elements of fortification*. There we supposed that a town should be fortified with a regular inclosure: and we shewed the application of the principles of regular to irregular fortification. Here we shall suppose that we must attack a town fortified regularly, and upon a level ground; and we shall afterwards apply the principles of the attack of regular to irregular towns.



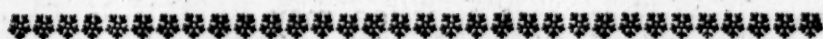
IV.

Of investing.

THE first operation of a siege is investing. The body of troops investing a town ought at least to be as strong again as the garrison; they are to divide themselves into several parties, in order to take possession of all the avenues leading to the place. By day they should keep themselves out of the reach of cannon-shot; but as soon as it is dusk they must approach much nearer, the better to be able to support each other, and to frighten the town. The

The investing is generally made by cavalry; but when the country is cut with ravins, or hollow ways, or when there are woods in the neighbourhood of the place, then there must be likewise a body of infantry to guard all the avenues, and even to stop up, by a kind of retrenchments, such as might be the easiest to penetrate.

A few days after the investing, the army arrives, and is disposed round the town, according to the ground taken up by the line of circumvallation, and assigned by the engineer who has the direction of the siege. As soon as the place is invested, they begin to trace the line of circumvallation, and afterwards they set about its construction.



V.

To trace out the line of circumvallation.

BEfore a general begins the attack of a place, he must endeavour to have as exact a plan of it as possible, by which he forms a design of the circumvallation and the attacks. The plan is rectified after the investing, as much as the vicinity of the enemy will permit; and thereby he may correct the design traced at first, as far as there may be occasion for correction. It is upon such a plan, so rectified, that we suppose a general to proceed. We shall therefore begin with explaining or tracing the operations of the siege on paper; after which we shall give the manner of transferring them to the ground. We shall exhibit the progress of these operations from the investing to the taking of the place, in the order they are really executed. The line of circumvallation being a fortification intended against the enemy from without, who should attempt to succour the town, its defences ought to be directed against that enemy, that is, they ought to be opposite to the town, and the besieging army should, as we have already observed, be encamped behind that line, that is, between it and the town. The camp should be, as much as possible, without

without the reach of cannon-shot ; therefore, as the line of circumvallation should be at a greater distance from the place than the camp, the reason is still stronger for its being also out of the reach of cannon-shot ; which, whether fired horizontally, or at an angle of ten or twelve degrees, may be reckoned about twelve hundred fathoms. According to the experiments made by M. Dumetz, we have seen, that a cannon-ball reaches much further. But in those experiments the cannon was fired at the greatest random, that is, at an angle of forty-five degrees ; and at this angle the effect of the shot is uncertain. In order that the cannon may be able to produce a determinate effect, or, which is the same thing, that a person may be able in some measure to answer for its shot, it ought to be fired under a more acute angle, though it may not reach so far. As the rear of the camp should not be incommoded by the cannon, this part ought to be above 1200 fathoms distant from the place ; and we shall suppose that the distance ought to be fixed at 1400 fathoms from the covert-way. The depth of the camp may be estimated at about thirty fathoms. From the front to the line of circumvallation there should be a space of 120 fathoms, to draw up the army in battalia behind the circumvallation ; which space added to thirty fathoms, supposed for the depth of the camp, gives 150 fathoms, and this, added to the distance from the covert-way to the rear of the camp, gives 1550 fathoms for the distance from the circumvallation to the covert-way.

This being laid down, if the place be a regular octagon, fortified according to M. Vauban's first method, the radius thereof will be 234 fathoms*. This distance being added to the 1550 fathoms, then we shall have 1784. Or we may make it a round number by adding sixteen fathoms, which are here of no manner of consequence ; and we shall have 1800 fathoms for the distance from the center of the place to the line of circumvallation.

* Elements of fortification, p. 43.

The radius of the circumvallation being thus settled, from the center of the place, with the distance of 1800 fathoms, you are to describe the circumference of a circle round the place. The diameter being 3600 fathoms, the circumference will then take 11314; then take the distance of 120 fathoms, which you are to carry to the circumference above described. This distance will be in this example 93 times, and something over, which differs very little from 120 fathoms; so that you may look upon the polygon of this circumvallation as a polygon of 94 sides, of 120 fathoms each.

The polygon * of the circumvallation being traced, † take on each of the extremities of its sides, the lines BD and BE, each of fifteen fathoms; and from the points D and E, taken for the center and distance of 25 fathoms, describe two arcs which cut one another at the point F, from whence draw the lines FD, FE, for the faces of the *redans* of the line of circumvallation: thus it is we call the salient parts EFD of this line, which serve to flank it.

Perform the same operation on every side of the circumvallation, and then you will have its master or principal line traced.

The parapet within must be six or eight feet deep; and without make a ditch parallel to all its parts, three or four fathoms in breadth. The parapet of the circumvallation will be seven feet and a half high, and the depth of the ditch equal to the height of the parapet.

‡ To make the profile of the circumvallation, let AB be the line level with the country, and CD the scale of the profile. Let A be the side of the town, and B that of the country; take AE, of six feet; from the point E, raise the perpendicular EF, of three

* Plate II. Fig. 1.

† We have represented only a part in the second plate; we should have had occasion for a very large one to represent it entire, and in its just proportions.

‡ Plate II. Fig. 2.

feet, and draw the line AF, which will be the talus of the banquette.

Draw FG parallel to AB, three feet from F to G, and the line FG will be the breadth of the banquette. On the point G raise the perpendicular GH, upon the line FG, four feet and a half.

Draw from the point H, HK, parallel to AB.

Make HK seven feet and a half, HI a foot and a half, draw GI, which will be the inside of the parapet of circumvallation.

Draw from the point K, on the line AB, the perpendicular KM; take KL a foot and a half, and draw IL, which will be the upper part of the parapet of the line of circumvallation. Take MN five feet, and from the point N draw the perpendicular NO, and set off seven feet and a half from N to O. Draw OR parallel to AB, three fathoms or eighteen feet from O to R; produce the line LN to P, and LP will be the scarp, or the outside of the parapet of the line of circumvallation. From the point R raise RS, perpendicular to OR, or parallel to ON. Make QR equal to OP, and draw QS, which produce beyond S three feet to V; then take SX six feet, and draw VX, and the profile of the circumvallation will be completed.

This kind of glacis, VX, will serve to raise the enemy, and to expose them more to the fire of the line, should they attempt to make themselves masters of it, and to cover the parapet of the circumvallation, in the same manner almost as the glacis of a place covers the top of the rampart.

The dimensions above given may vary a little without inconveniency; but it would be to no manner of use to make the lines stronger; only you may reduce the ditch to ten or twelve feet in breadth at the top, and five or six feet in depth. A ditch of less breadth and depth, besides its not allowing ground enough to form a good parapet, would have the inconveniency of being too easy to pass over by the enemy.

The lines may be fraised; which is done when they are to last for some time, and the neighbouring country furnishes wood enough for the purpose.

Sometimes a fore-ditch is dug before the lines, twelve or fifteen feet in breadth at the top, and six or seven feet deep; it is made about twelve or fifteen fathoms from the ditch of the line. The design of it is to stop the enemy when they attempt to attack the lines, and to make them lose both time and men in passing over it. As it is exposed to the fire of the lines, the time the enemy must necessarily spend in crossing, will of course occasion their losing a great many men; and besides, the passage itself may throw them into such disorder, as shall prevent their attacking so advantageously as they would otherwise do, were it not for this obstruction.

Notwithstanding these advantages, M. Vauban disapproved of this fore-ditch, from a notion that if the enemy can get there, they are covered against the fire of the circumvallation: and he condemns it expressly in his Memoirs. But, with due deference to this great man, it seems that the engineers have not been all of his opinion upon this matter; and though it be true, that the fore-ditch serves as a cover to the enemy when they are in it; yet it retards their march, and keeps them longer exposed to the fire of the lines. Accordingly *fore-ditches* have been made to lines on different occasions, since the death of marshal Vauban, particularly at Philipsburg: and there is no doubt but they would have proved of great use to us, if prince Eugene had determined to attack our lines. Between this fore-ditch, and the ditch of circumvallation, at the siege of Philipsburg, in order to strengthen the defence of the circumvallation, we had likewise dug wells, which were ranged chequerwise, of about nine feet diameter at the mouth, and six or seven feet deep. They were situated near to each other, to prevent the enemy from passing easily through the intervening spaces. The ground they occupied would have been
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extremely difficult for the enemy to pass; they would have retarded his march, and the fire of the lines, which entirely commanded the passage, would, without doubt, have killed a great many men.

The Spaniards practised something of this kind at the siege of Arras in 1654. Before the circumvallation, they dug a number of holes two feet diameter, and a foot and a half deep, in which they fastened stakes, that were capable of greatly obstructing the passage of the cavalry.

The third plate exhibits the plan of the intire circumvallation of Philipsburg; and the fourth plate gives a part of this circumvallation in great, with the wells and the fore-ditch. In the same plate you see a part of the circumvallation of Arras, of which we have been just now speaking.

A line of circumvallation requires a strong army to defend it. We have found the circumference of the line which we have been now tracing, namely, of 94 sides, each of 120 fathoms, to be 11280 fathoms; out of this number the gorges of the redans are to be deducted, but then their faces are to be added. The gorges have 30 fathoms, and the two faces which have 50, give an overplus of 20 fathoms on each redan; that is, to the number above mentioned of 11280 fathoms, add as many times 20 as there are redans, in order to have the intire circumference of the circumvallation. This circumference has 94 redans; therefore we must add 94 times 20, or 1880, which will make 13160 fathoms for the whole circumference. This number being divided by 2282 (which is the number of fathoms contained in a French league) gives about five leagues and a half. Now it is clear, that so great an extent of ground requires a very numerous army to guard it. We may make a calculation pretty near, by supposing that every soldier drawn up in a line, occupies a space of three feet, that is, half a fathom, that the soldiers are four deep, and that the army is drawn up in two lines, which will give

give eight ranks of soldiers. Each rank containing 26320 soldiers, the circumference of the circumvallation being 13160 fathoms, the eight ranks will therefore make 210560 men.

To these we should likewise add about twelve or fifteen thousand men for the works of the attack, which would form an army of about 225000 men. And as it is not customary, at least in Europe, to send such strong armies into the field, from thence it follows that the circumvallations, and the lines in general, when they are of a very great extent, are extremely difficult to guard. And indeed the most celebrated generals have been divided in their opinions upon this subject. They all agree that there are certain cases in which they may be of some advantage, especially when they are of a narrower compass, and the design of them is to stop up the entrance of a country of a small extent; but if they are very large, it is extremely difficult to defend them when attacked by a skilful enemy.

It was heretofore the custom to add great outworks to the lines, such as horn and crown works, tenailles, &c. All the circumvallations of the towns that were besieged during the wars between Spain and Holland, under the princes of Orange, were remarkable for this sort of works. These have been since laid aside, because we find that even a line, with its simple redans, is very difficult to guard; and such a number of outworks does but increase its circumference. The modern lines have only a few small half moons * A, before the gates of the circumvallation, placed like those of the towns, against the middle of the curtains; the entrance is shut up by wooden barriers, and sometimes by chevaux-de-frize, and other contrivances, which will hinder the passage from being easily forced.

The lines having very little elevation, stand in no need of bastions to be flanked in all their parts, like

* Plate II. Fig. 1.

those in the circuit of a town. Redans, which are of more simple and expeditious construction, are sufficient. The angle they make with the curtain is always very obtuse, to the end that the soldier being placed on the face of the redan, may be the better able to defend its approach. It is customary, indeed, to make bastions in those parts, where the lines form such angles as could not be sufficiently defended by redans. Yet, whenever it may be judged necessary, the line of circumvallation may be fortified with bastions. The greatest part of the lines at the siege of Philipsburg was flanked in this manner, as may be seen in Plate III and IV. The bastions increase the circumference of the circumvallation; and probably the reason why they were used at the siege of Philipsburg, was because the circumvallation was of a very small extent.

At the point of the redans, batteries are erected to fire the cannon *à barbette* over the parapet; and the same is practised wherever the cannon are placed on the line of circumvallation.

A computation is generally made of the time requisite for making the lines, which is very necessary, in order to determine what day the trenches may be opened; this being seldom done till the line of circumvallation is completed. Such a line as that we have been speaking of is, according to marshal Vauban, a work of nine or ten days. When the ditch is narrower, and not so deep, it is made with greater expedition.

The calculation of the time requisite for constructing the lines, is made by measuring the excavation of the ground, of which they are to be formed, by the fathom; or, which amounts to the same, by measuring by the fathom a space of six feet of the length of the line, and computing the time a man will take up in doing it. As the like space is given to each of the workmen, the line is made nearly within the time that one single workman would be about the space assigned him.

Experience shews us, that a workman in digging of earth of ordinary consistence, may, in a day's labour,

hour, dig about the third of a cubic fathom, that is, he may dig such a cube in three days, which will serve to determine pretty nearly the time of the construction of the lines, relatively to their assigned dimensions.

From what we have been saying, it follows, that when we know the circumference of the lines, we know likewise the number of workmen to be employed therein, reckoning one man to each fathom in length.

The workmen employed in the construction of lines, are generally peasants who are ordered for this purpose from the neighbourhood, and who, according to M. Vauban, should have a double allowance of bread given them, that is, one ration more than is allowed to the common soldier. It is not usual to give them any thing else.

When there is no possibility of getting peasants to work on the lines, then the troops are to do it: no part of the army is exempt from this duty; horse and foot must serve alike.

Hitherto we have supposed that the circumvallation was regular; but even were it irregular, the construction of it would differ very little from that which we have just now given.

It is sufficient to observe with marshal Vauban,

1st, That the circumvallation ought to occupy the most convenient ground about the place, that is, the easiest to defend, the most difficult to attack, and the properest for the security and conveniency of the troops; and the redans should be placed on the highest part of the ground, and not in a bottom.

2d, That the camp should be out of the reach of the cannon of the place.

3d, That the camp ought not to be too much extended, and no more ground should be occupied than is necessary for the security of the troops.

4th, That a general ought to possess himself of all places from whence the lines may be commanded, when it is possible to do it without carrying the circumval-

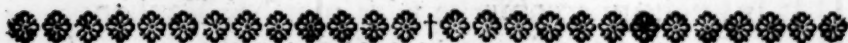
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lation to too great a distance; and that he should take all advantages arising from the nature of the ground, as precipices, eminences, rivers, brooks, morasses, and, generally speaking, whatever is capable of rendering the camp of difficult access. If there are any woods or bushes within its inclosure, it will be right to cover it in those parts by felling the trees, and therewith making a proper fence.

5th, If there are any rivers or brooks that pass through the circumvallation, and divide the camp into several parts, care should be taken to have a number of bridges of communication betwixt the quarters; to the end that in case of an attack, they may be able to assist each other with ease and expedition.

The tracing of these lines admits of no manner of difficulty, if you have a good map of the adjacent country; since you have only to bring the several parts of the line nearly within 1800 fathoms of the center of the place, and to take care that there shall be about 120 fathoms from the point of one redan to another.

Nor is there any difficulty in transferring this line to the ground; the operation is too easy to those who know a little of practical geometry, to lose any time in explaining it here.



VI.

Of the park of artillery.

THE park of artillery is the place which contains the cannon, bombs, powder, and in general all military implements and machines, that have any relation to the artillery.

This park should be placed where there is least danger of being insulted by the enemy. It ought to be without the reach of cannon-shot, and inclosed within a particular spot, which should be fortified also by a line, consisting of a ditch and a parapet, flanked with redans in the
same

same manner as the circumvallation. Nothing should be neglected that is capable of securing it either from the attacks of the enemy, or from any other possible damage.

There are several parks used in a siege; the great one, which is simply called the park, and is that of which we have been speaking, serves as a general magazine for all the artillery. The little parks are more within reach of the enemy's attacks, and contain the stores and ammunition necessary for daily use, for which reason they are supplied every day. They are distributed in places where they may be as safe as possible; and there are as many in number, as there are attacks.



VII.

Of the line of countervallation.

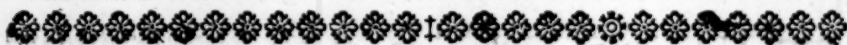
THE intent of this line, as we have mentioned in the definitions, is to secure the besiegers against any attempt from the garrison. It is never made but when the garrison is numerous enough to disturb the besieging army.

It is constructed in the rear of the camp in the same manner, and pursuant to the same rules, as the circumvallation. The whole difference is, that as it is made to oppose a far less considerable body of troops, than that which may attack the circumvallation, the parapet need not be so thick, neither need the ditch be so wide, nor so deep. The thickness of the parapet may be only six feet, and the ditch no more than eight feet wide at the top, and five deep. The redans are constructed in the same manner as in the circumvallation; and a view of the figure, Plate V, will sufficiently point out whatever relates to this line.

There are few lines of countervallation made at the present time, because the besieging army is generally so superior

superior to the garrison, that the latter can hardly run the risk of sallying out to attack any part of the enemy's army, without manifest danger. Among the ancients the use of this line was more frequent ; but indeed their garrisons were far stronger than ours : for as the towns-people were almost the only soldiers in those days, there were generally as many troops to defend the place, as there were inhabitants.

The lines of circumvallation and countervallation are very ancient ; for we find instances of them among historians of the greatest antiquity. Yet the author of the military history of Lewis XIV. pretends that Cæsar was the first inventor of them : but we may see in M. Folard's treatise of the attack and defence of places among the ancients, how little foundation there is for such an opinion : for this author asserts, with great probability, that these lines are co-eval with the first inclosing of towns within walls, that is, with fortifications of the earliest date.



VIII.

Of the trenches and parallels.

WHILE the line of circumvallation is finishing, all the materials necessary for the construction of the trenches are got ready, and the engineer, who has the direction of the siege, examines on the spot the most proper place for the attacks, and the figure they ought to have ; and of these he makes a particular plan.

In regard to this subject, there are a great many things to observe. We have supposed that the place is regularly fortified, and on level ground ; so that here it is indifferent on which side the attack is begun. It is sufficient to explain the rules that are to be there observed, and afterwards to apply them to irregular towns, and to uneven grounds. Let C (Plate VI.) be the place besieged, and A and B the
battions

bastions attacked. Begin with indefinitely producing towards the field, the capitals of these two bastions; in like manner produce the capital of the half-moon opposite the curtain between these two bastions; set off 800 fathoms from the salient angles D and E, of the covert-way, to F and G. This done, take DH, and EI of 300 fathoms; and from the center C, with the radius CH or CI, describe an arc, which produce beyond the points H and I; and on this arc HI construct the first parallel. Then on the same lines, DF, EG, take the points M and N 140 fathoms distant from the points H and I, and through these points, describe from the center C another arc, on which the second parallel is constructed. This second arc will cut the produced capital of the half-moon, in the point L, which is to be observed, in order to begin from hence a trench, which shall extend to the salient angle of the covert-way before this half-moon. Lastly, through the points O and P, the distance of 20 or 25 fathoms from the angles D and E, describe from the centre C, a third arc, on which the third parallel is constructed.

Terminate the first parallel by producing the faces *ab*, *ab* of the half-moons 1 and 2, collateral to the bastions A and B; but extend the parallel 15 or 20 fathoms beyond the intersection of this prolongation. The second parallel will be less extended than the first, by about 30 fathoms on each side: and the third also less extended than the second, by about 30 fathoms on each side.

This being done, you have a sketch of the trenches, and the places of arms. The business now is to trace the trenches, or approaches, without being seen or enfiladed.

Take a long ruler, and lay it on the point G, so that it shall make, with the produced capital EG of the bastion B, an angle EGS, whose side GS being produced, shall meet no part of the covert-way, and shall be distant about 10 or 12 fathoms from the angles
to

to which it approaches nearest, and this in order that the trench towards the side GS may not be enfiladed from any part of the covert-way.

Take GS of an arbitrary extent, as of 200 or 220 fathoms, and put the ruler on the point S, so that it shall make, with GS, an angle GST, the producing of which on the side ST, shall not fall on any part of the covert-way, and it will be 10 or 12 fathoms distant from the most salient parts. Terminate this side in T, and there make also a new angle STI, whose side TI should terminate at the point I, where it meets the first parallel. Perform the like operation on FH, and it will give you the outline of the trenches as far as the first parallel.

At this part of the trenches you may make a greater number of turnings; you may likewise carry it in a direct line to the first parallel. The most important article is, to take care not to let it be enfiladed from any part of the covert-way; and the fewer angles and turnings it makes, the quicker it is constructed, which in transferring it to the ground is worthy of great attention. Mind also, that its extremity I does not fall far from the point, where the produced capital of the bastion meets the first parallel.

By the same method trace the trenches between the first and second parallel, as may be seen in the figure; but as this part is nearer the place than the former, in order to avoid being reaked, it must have a greater number of angles. All its sides ought to cut the prolongment of the capital of the bastion B, as appears by the figure. In like manner trace the trenches betwixt the second and third place of arms, by making as frequent turnings on the produced capital of the bastion B, as shall be necessary, in order to its defiling from the covert-way. By the same method trace the trenches on the capital of the bastion A; trace also a trench on the produced capital of the half-moon, between the second and third parallel, to reach the flanked angle of its covert-way.

When

When the garrison happens to be strong and enterprising, it will be proper, between the second and third parallel, to make parts of trenches U, U, &c. parallel to the places of arms; they are to be 30 or 40 fathoms long, and to communicate with the trench, as may be seen in the figure. These parts of the parallels are what we have distinguished by the name of *half parallels*, or *places of arms*. Now to trace the whole trenches and the places of arms, of which we have been only giving a sketch or outline, you are, at the distance of 12 feet, to draw parallels to the line we have been tracing, which expresses the trenches, and in like manner, to that which expresseth the parallels or places of arms.

At every angle of the trenches observe to produce the part of the trenches in those places, so that this prolongation shall cover that part of the trenches which it terminates.

This will be illustrated by an example.

Let ABCDFGMQ, (Plate VII. Fig. 1.) be a part of the trenches, and let AB be one of the sides opposite to the enemy; produce AB, so that BE shall be five or six fathoms; and in FG, take also five or six fathoms from I to L, which will give the end of the trench BELI, the use of which is to cover the *boyau* or branch IOMG, whereby the enemy will not know the place where it falls into the trench AB, and to make room for withdrawing those who are in this part of the trenches, and that the passage may be free at all the angles. In like manner produce the side GM, from M to N, and the side IC, from O to P, and you will have the end of the trench MNOP, which will cover the branch DCOQ. Do the same at all the angles of the trench.

The parapet of the trench being made to cover it, the parapet ought to change sides alternately. If, for instance, AE, in the preceding figure, is towards the place, it is evident that the side GN will be towards it also, and likewise the side CD; and therefore the parapet of the trench is successively constructed from the
D right

right side to the left, and from the left to the right. In the plans of attacks, the side of the parapet of the trench, as also that of the parallels, are distinguished by a stronger line than any of the rest; but the latter admits of no difficulty, because we may easily conceive, that being parallel to the place, its parapet must necessarily be on the side that faces it. Care has been likewise taken to express, as we have already mentioned, in the figure, the parapet of the branches, by a stronger line than the other lines of the attacks. The side of the trench opposite to the parapet, is called *the reverse of the trench*.

What we have been mentioning is sufficient to trace the trenches upon the plan of a regular place on even ground. In order to give all that can be said relating to this subject on paper, there remains only to add a word or two of their depth, and of their parapet.

The trenches are generally no more than three feet deep, and their parapet, beginning from the bottom of the trench, is six feet and a half high, or thereabouts. The parallels have a parapet like the trench, and of the same height; but as they are intended for firing over, they are made with a kind of banquette, as may be seen Plate VII. Fig. 3. to raise the soldier, to the end that he may fire over the parapet. On the parapet of the places of arms, are put baskets, fascines, or sand-bags, ranged in such a manner that the troops may be able to fire without being too much seen by the enemy. In Plate I. you see in what manner the sand-bags ought to be disposed for this purpose. The third parallel, or place of arms, is generally wider than the rest. Sometimes the inside of its parapet is likewise made with steps or banquettes, to the end that the soldiers may conveniently pass over it in case of an attack. The fourth figure of the seventh plate shews the profile thereof.

There will never be any great difficulty in tracing the attacks, even of an irregular town, and upon uneven

even ground, from an exact plan, by observing the method we have made use of to make its parts defile properly.

But the difficulty is to transfer the works from the plan to the field, and to direct the attacks of an irregular fortification, on irregular ground. By irregular ground we understand that which does not permit an army to extend itself on every side, which is cut by morasses, or subject to be laid under water by the town; or, in a word, which has only some parts fit for continuing the trenches. Here it is that the knowledge of an able and experienced engineer is requisite, in order to obviate the inconveniencies of such a spot, a thing that can be done but imperfectly upon paper. Yet to convey some idea of the manner of proceeding, we shall here transfer the above traced attacks to the ground; but to such ground as hath been already mentioned, equally accessible in every part. Before it is done, we must from all the angles of the branches of the trench, upon the plan, draw perpendiculars to the produced capitals; observing the distance of each of these perpendiculars and their length. It is evident that if the capitals were marked on the ground, and it was possible to perform the operations there with any conveniency, the trench might be traced with all ease, because by stretching a cord successively from the extremity of one perpendicular to another, you would have the first trace, or the zig-zag, of the trench: but nothing can be traced on the ground; for the operation is to be performed by night, in order to conceal the knowledge of it from the enemy, who will be very little disposed to let the besiegers carry on such an operation unmolested. The following is a method that may be made use of.

The engineer may walk about in the day-time at a sufficient distance from the place, to be without the reach of musket-shot. It is not usual to fire cannon against a single man, because the shot is very uncertain, especially against a person, who does not stand still for any time; therefore without any great danger, he may

only keep himself out of musket-shot. It is easy to discover the flanked angle of the bastions, against which he wants to direct the attacks, and the saliant angle of the covert-way, opposite to them: which gives two points, and these the direction, or the prolongation of the capitals of those bastions. Consequently he has only to plant some pickets on the direction of these points, in order to have the prolongation of the capitals of the bastions. These pickets can only be put out of the reach of musket-shot; but by day-light he may observe something of the ground, lying in the direction of these pickets, and he may afterwards reconnoitre it in the evening, in order to place pickets there also.

In this manner he may have the prolongation of the capitals pretty exact.

In order to conduct the trench by these capitals, the following method has been pointed out by marshal Vauban.

Examine upon the plan of the attacks, what distance there is from the beginning of the trench to the first perpendicular; measure this perpendicular and the side or part of the branch corresponding to it; take cords of equal length with these lines, and fasten the extremities of the two cords, one representing the length of the line of direction, and the other that of the branch which makes an angle with it, to a picket at the point of the produced capital where the trench begins, and make two men walk, each of them holding one end of these cords, *viz.* one in a direct line towards the place, the other also advancing towards the place, and walking along side of the former. When the first comes to the furthest distance betwixt the opening of the trench, and the first perpendicular, he must plant a picket on this point, to which he is to fasten the cord which expresses the perpendicular. He must take the other end of this perpendicular, and afterwards turn off to the right or to the left, according to the side where the perpendicular ought to be, till the part of the cord expressing the perpendicular is well stretched,

stretched, and joined to that end of the cord of the trench, carried by the other man : at their meeting they are to plant a picket, by means of which the triangle, thus transferred to the ground, will be like that which was taken upon the plan ; and this part will be traced on the ground in the same manner as on the plan.

You may have as many cords, as there are windings or turnings in the trench, and you may trace every part of them in the manner above laid down, at least in the beginning, and when the trench is yet at a distance from the place.

Let the trenches be traced upon the plan, (Plate VI.) in the manner already shewn, and let C be the place against which you are to direct the attacks, transferring the plan to the ground : let BG be likewise equal to the line of direction of the plan ; you are to plant along this line a sufficient number of pickets, with burning matches tied to them, in order to discover them the more easily.

To begin the tracing of the trenches, tie to the picket G, a cord of the length GS. and to the same picket another cord of the length GX ; let there be two men, and each take an end of these two cords, and let them walk, the one at a venture towards S, and the other directly to X towards the place along the line of direction BG, and having reached the end of his cord, let him fasten it with a picket, after having drawn it very straight ; and to this picket let him tie one of the ends of the cord, which is to mark the perpendicular XS. Let him take the other end, and walk towards S till his cord XS is stretched very tight, and then let him join the man who holds the end of the cord GS, and let them fasten a picket in S, where both the cords join. Let them afterwards take away the cord XS, the perpendicular which is of no use, and the cord GS which remains, will mark the real tracing of the trenches. In order to have the line ST, you come to the picket X ; to which you tie a cord of the length of XY, and another to the picket S, of the length of

ST. Let two, as before, take each an end of these two cords, and let them walk, the first who holds the end of the cord XY, directly towards Y, and the other who holds the end of the cord ST, obliquely towards T; he who holds the cord XY, having reached Y at the end of his cord, shall place a picket there; to which let him tie the end of the cord of the perpendicular YT, and let him walk towards T, holding the end of this cord, till he meets or joins the man who holds the end of the cord ST, and at the point T of their meeting, let them place a picket, to which let them tie the end T, of the cord ST. After this take away the cord of the perpendicular, and thus continue the same operation as long as you please, or are able, in order to trace all the other turnings or windings of the trenches.

This whole operation supposeth that you know exactly the distance of the point G, the extremity of the line of direction to the top E, of the saliant angle of the covert-way: to find this distance many ways may be learnt from trigonometry; but you may make use of the following, which is pointed out by marshal Vauban, and is the most simple.

Let A (Plate VII. Fig. 5.) be the vertex of the saliant angle of the covert-way, and AB, the line of direction of the trench, whose length you want to take. At the point B, draw BC perpendicular to AB, to which give what measure you please, as 80 or 100 fathoms, and at the point C, draw CD perpendicular to BC; divide BC into several equal parts, as four, six, or eight, and place pickets in each of these divisions. Walk along CD, and look out for a point on this line, which shall be in the direction of A, and of one of the pickets of BC. Suppose that BC is divided into four parts, and that G, which is the picket of the third division, is in the direction of the point E of the line DC, and at the vertex A, of the saliant angle of the covert-way, you have the two similar triangles BGA, GCE. Therefore, as BG, the base of the former,

former, is three times GC, the base of the second, it follows that CE is the third of AB, and that thrice CE will give the length AB. If GC was only the fourth part of BG, CE would be only the fourth part of AB, &c.

When once you have found out by this, or such other methods as you may make use of, the length of the line of direction EG, Plate VI, you will be always able to know the distance that remains to the salient angle of the covert-way, and to the points I, N, P, (Plate VI.) through which the parallels or places of arms are to pass. These points being determined, it would be an easy matter from geometry to find out a method of describing the parallels that are to pass through them, if their situation admitted the engineers to perform the operation quietly by day-light, but they are to be traced in the dark, and under the fire of the place; so that there is no other way to trace them than by approximation, that is, to move as nearly parallel to the circuit of the place, as you can by your judgment; and to plant pickets with cords tied to them at proper intervals, the whole length of the line. But you can trace with cords only the first parallel; for the others are too near the place to be able to perform this operation; you are therefore to proceed in tracing them almost in the same manner, as we shall observe when speaking of the *sap*, to which they belong, and which are carried on by that method.

From what we have been saying, the opening of the trenches, and its several operations, may be much easier to understand, than without this explanation. One ought to have a perfect idea of the tracing of these works, to be able to execute them with any tolerable ease.

IX.

Observations on the properest part for making the attacks.

WHILE the lines are a perfecting, the necessary materials are to be got ready for the construction and operations of the attacks. The materials consist of fascines, pickets three feet long, and about an inch or two in diameter, gabions, and pickets for gabions. There must likewise be a provision of the several instruments, or tools necessary for these operations.

The engineer, who has the direction of the siege, will likewise make use of this time to examine into the parts most convenient for carrying on the attacks, and where they will be most simple and expeditious. There are few fortresses in Europe of which plans are not to be had; but as it is presumed that the enemy hath increased the fortifications of a town which is threatened with a siege, care should be taken to get intelligence thereof from some skilful person that has been in the place, and made all the observations possible in regard to the works lately raised, without giving any suspicion of his intentions. The danger of such an undertaking is very well known, so that the person employed cannot be too cautious in keeping himself concealed.

While the circumvallation is making, the engineers may at a distance, or, as we have already observed, out of musket-shot, examine some part of the outworks; and afterwards, from the report of the person sent into the place, and from what they know themselves, they may settle with the general the properest and fittest place for carrying on the attacks. On this occasion there are many things to be observed, as well with regard to the ground, as to the fortifications; but

but in a work of this nature, it is sufficient to consider the points of most importance.

First of all the nature of the ground about the place must be well observed, whether there are any ditches or hollow ways, that may serve as a cover to guards of horse and foot against the cannon of the place. Whether there are any parts that command the town, and may serve for the erecting of batteries; and whether the ground is fit for the works. The most favourable circumstance is to find a soil easy to dig; then the works advance with ease and less loss, because the soldier is soon under cover, and the cannon does not do half the mischief as in stony places; for here it makes the shivers fly about, which wound a great many men; and besides, instead of sinking as in a good soil, it makes a number of rebounds, which greatly obstruct the progress of the works. If the ground about the place is a pure rock, or a morass, then the operations are still more difficult; besides, there will be occasion for a vast quantity of fascines, sand-bags, wool-packs, &c. and the workmen are in much greater danger.

The rivers which run through the town, or in the neighbourhood, do likewise deserve consideration; for they separate the attacks, and it may happen by some stoppage of the water, or other accident, that the bridges of communication being broke down, the separation of the attacks will expose the army of the besiegers to be defeated, by which means the place may be relieved. It is proper also to enquire, whether those rivers are not subject to inundations, which if they were to happen during the siege, and to break in upon the attacks, would oblige the besiegers to abandon the trenches, and to raise the siege. In a word, whether the town can command any quantity of water so as to make an inundation round the place, and to lay the ground appointed for the attacks under water. All these points, and a great many others which we do not mention, deserve the most serious attention. On the chusing a proper ground for the attacks, the success of

of the siege generally depends; for which reason the engineers and the generals, who are particularly concerned in this choice, spare no pains to obviate every inconveniency that the besieged may make use of to retard the progress of the works. All that the enemy can do, ought to be foreseen, in order to prevent or remedy it effectually.

After chusing the properest ground for the attacks, a general is to consider the front, which is least fortified, and least covered with out-works. All other things being the same, it is evident, that the fewer out-works there are, the easier will be the attack. But if the place is situated in a morass, or upon an eminence, then he is streightened by the ground; for let the out-works of the accessible side of the place be what they will, it must necessarily be attacked on that side. If the town is situated on the bank of a great river, as Mezieres, Namur, Thionville, Strasburg, Philipsburg, &c. which occupy only one side of it, and maintain the other by little forts; then it is most advantageous to attack that side next the river above or below, flanking the right or left of the trench, with the bank of the river, and carrying another trench on the opposite bank, with an intent to take possession of those works, and to occupy a proper situation for placing reverse batteries opposite the grand attacks. In a word, the whole choice of the attacks consists in finding out the properest ground, and the weakest side; but as it is to be presumed, that the enemy are acquainted with the nature of the ground about the place, and therefore have taken care to fortify more exactly those parts which are most favourable to an attack, the besiegers should not hesitate to make their approaches on that side, where, by the situation of the ground, they may gain, what the increase of the fortifications might otherwise make them lose.

But in regard to places surrounded with morasses, it is to be observed, that some of those which are looked upon as inaccessible, may happen to be otherwise; and that

an exact knowledge of their situation will greatly facilitate the taking of the place, by carrying on the approaches on that side, which there is reason to think is less fortified, as the enemy judged it more difficult to attack.

R E M A R K.

It is a common thing in sieges to make several attacks, that is, to open the trenches on two, and sometimes on three different sides, either with a view to divide the attention of the garrison, or in case there be too many difficulties on one side, the progress of the attacks may be continued on the other, without being obliged on that account to open the trenches anew. Each of these attacks is made on the same principles, and in the same manner; therefore the description we are going to give of one may be applied to them all. The only thing particular is, that the different attacks ought to be disposed in such a manner, that the shot which comes from one shall do no damage to the other, and that they shall be able to assist each other if needful. Of these attacks, generally speaking, no more than one is intended to be continued to the end, in order to force a way into the place: this is called the *real*; and the other, *sham attacks*.



X.

Of opening the trenches.

EVERY thing being ready for opening the trenches, the ground pitched upon, the attacks settled and drawn upon a plan, and stores or magazines of all the materials necessary on the occasion, being within reach of the place where the pioneers propose to work; the general having also settled the round of duty for the guard of the trenches, both of horse and foot, as likewise

wife the number of horse for bringing the fascines, with the number of pioneers and troops to support them; and the chief director of the engineers having acquainted the rest of the corps with his plan of attack, and the manner they are to act; in a word, every thing being ready for execution, the troops designed for the service of the first night being prepared and drawn up in battalia at the place of rendezvous, and the pioneers provided with fascines, pickets, shovels, and pick-axes; in the dusk of the evening they all begin to advance, every soldier being obliged to carry a fascine, together with his arms, in order to reach the place designed for opening the trenches. The guard of horse march at the same time to their assigned posts, to the right and left of the attacks, ready to support the troops for the guard of the trenches, in case of any fall from the enemy. All this is to be done with the greatest silence possible, and nothing should be neglected to conceal the design from the enemy.

The pioneers are, according to marshal Vauban, divided into brigades of fifty men, each commanded by a captain, a lieutenant, and two serjeants. They advance four or six abreast, near the place where the trenches are to be opened; after which the rest of the troops that are to support them, being come up, the engineers charged with the tracing of the trenches, and who are to place the pioneers, make them come forward where the opening is to commence, while the battalions that support them are drawn up to the right and left in the places assigned them, where they unload their fascines, and silently wait for further orders. In the mean while the engineers trace the branches of the trenches, as we have already observed*; the director places the first cord (Plate VI.) from G to S,

* The trenches are not always traced with a cord in the manner above-explained; sometimes the engineers trace them with fascines. For this end they place the pioneers along the lines which they have marked in the day-time with pickets, and they make them lay their fascines

S, or traces the line G S, and the other engineers afterwards trace the other branches from S to T, and from T to I. The same is done on the other side of the attack. The tracing of these two parts is done at the same time; they likewise begin to trace the first parallel this very day, and the work is advanced as fast as possible.

As much work is undertaken as the pioneers can be expected to perform this first night: and in proportion as the tracing goes on, the engineers place the pioneers, making them file off one by one, each carrying his fascine under the right arm, if the place is on the right; or under the left, if it is on the left, to the end that by the position of their fascines, which they lay on the ground along the tracing, and on the same side as they carry them, they may be enabled to distinguish the side of the place, that is, the side towards which they ought to throw up the ground, in order to cover the trench from the fire of the town. As fast as they are placed, they are ordered silence, and made to lie down with their face on the fascines, and not to begin to work till commanded. The whole operation begins at the same time, that they may advance equally. When every thing is ready, and the pioneers are all placed along the tracing, which is purposed to be made this first night, orders are again given for them to work, and then they all set about it with all the diligence possible till day-light, that they may be covered against the fire of the place, which is still very dangerous in the morning, considering that the trench has not had time as yet to be rendered so perfect as it

fascines on the ground along these lines. It must be acknowledged that this operation is performed more exactly with the cord; but when precaution has been taken to have an exact view of the ground several days before the opening of the trenches, and pickets have been placed there, in order to determine the lines to be traced, and, in short, when the engineers are able to distinguish the ground in the night, the tracing of the attacks may be made in this manner with tolerable exactness.

ought.

ought. The troops that are to support the pioneers, are put under cover on the back of that part of the trench which is finished ; that is, on the border of the trench opposite to that on which its parapet is raised ; they are made to lie on their faces, after which the pioneers, who have been upon duty in the night, begin to file off, and others fill up their places.

It is very difficult this first day to render the trench as complete as it should be, but no pains are spared to make it as complete as possible.

As the design cannot be now concealed from the enemy, the guard mounts the next day with drum beating about noon ; and care is taken to continue the work of the trenches the second night, in the same manner as the first, that is, by placing the pioneers uncovered, because they are at such a distance from the town, that the fire is not yet dangerous enough to require their being placed otherwise ; the work goes on quicker in this manner, but it must necessarily be altered as soon as the workmen come within musket-shot of the place.

If the whole compass of the first parallel has not been undertaken the first night, it is to be done the second ; and the branches of the trenches are still carried on, though with less vivacity and progress than the first.

The first night is the best adapted for advancing the works of the trenches, because of the distance from the place, which is too great to apprehend any danger from the enemy's fire. Sometimes it happens so, that the enemy are not apprized of these works ; especially when all the necessary precautions have been taken to conceal them, and in that case the business is done in a manner without loss or danger. It is of importance to advance them with such expedition, that they may be fit to receive the troops, who are to support the pioneers, in order to cover them against the fire of the place : and as the first parallel is designed for this purpose, therefore it cannot be perfected too soon.

This

This line is made with a view to protect the advanced works, which become more difficult in proportion as they draw near the place; and it is but prudent not to run the risk of their being destroyed by the enemy; for by being too hasty a contrary effect would follow. The grand rule is not to advance faster than you are able to maintain your ground.

According to marshal Vauban, the first place of arms, though begun the first night, has need of a second and a third before it can be completely finished, and in condition to hold the troops that are to guard the trenches; but the works for perfecting this line will not hinder the besiegers from advancing to the second parallel, which ought not to be begun till the fourth night. It is to be observed, that the guard who mount the trenches are changed every day; they mount about noon, and they are to be as strong as shall be requisite for opposing the sallies, which the garrison of the place may make against the workmen. They are generally two-thirds of the garrison, because the enemy may fall upon the trenches with that number, reserving the other third to guard the town. But as it is possible that the besieged may think proper to sally forth with their whole force, and fall upon the workmen, together with the troops that support them, I am of opinion, that in order to guard against every accident of that sort, the troops in the trenches ought to be nearly equal to those of the place, especially in small towns, where a few are sufficient to guard the posts, or where the burghers are so well attached to the prince, that the commandant may depend upon their fidelity in guarding the town, because in that case he may make a general effort with his whole garrison against the troops in the trenches.

We have observed, that the second night the pioneers may still be placed uncovered; but the third it would be very dangerous to do it, because of the enemy's fire being too near. When the engineers are of this opinion, they take care not to expose the men any longer uncovered,

uncovered, and then the works are carried on by *sap*, a name in all probability derived from the common acceptation of this word, by which is understood an excavation made under something, or behind something which you want to destroy or overthrow; so in the works here in question, the soldier makes an excavation behind a mantlet, or a gabion, which shelters him from the cannon of the place. Be that as it may, it is of importance to know in what this work consists, which is of very great use in sieges; and this we shall demonstrate in the following article.



XI.

Of the sap.

LET ABC (Plate VII. Fig. 6.) be the part of the trenches advanced to A, so near the town as to render it impossible, without evident danger, to work any longer at the approaches, unless the men have some cover against the fire of the place: and let the branch AD be traced by the engineer, not with a cord, as at the opening of the trenches, but with some pickets, which he has taken care to place in the direction this branch ought to have, to serve as a guide to the workmen. A cut is made in the parapet BA of the trenches, and then the men designed to work by *sap*, who are therefore called *sappers*, will move forward through the opening A, successively eight in number. The first is to roll before him a mantlet, to cover him against musket-shot. He advances as far as is necessary to place a gabion on the line AD, and this gabion being set on its base, in the proper situation, with the pickets uppermost, the sapper makes a little trench behind, about six inches distant from the gabion, of a foot and a half in depth, and as many in breadth, and he empties the earth of this ditch into the gabion. This done, he places a second gabion near the first, in the same manner,

ner, and always under the cover of his mantlet; in like manner he makes a ditch behind, the earth of which serves to fill his gabion. Thus he places a certain number, till he grows tired of the operation.

The second sapper, who immediately follows him, widens the ditch made by the former by six inches, on the opposite side to where the gabions are placed; and makes it half a foot deeper. The earth he digs up serves to fill the gabions of the first sapper. The third sapper widens the ditch of the two first likewise half a foot, and he deepens it in the same proportion.

At length the fourth enlarges it also in the same proportion, in breadth and depth; and then the trench is three feet wide, and the same in depth, which is as much as it ought to be. The earth dug up on this occasion, is sufficient not only to fill the gabions placed by the sappers, but likewise to make a parapet of the rest, which is thrown up, and is strong enough to resist musket-shot. The third and fourth sapper lay the fascines over the gabions, with their hooks, or otherwise; then they press them down, so that the stakes of the gabions shall keep them firm. As the sappers are ranged by brigades of eight each, while the first four are working at the sap, in the manner above described, the other four furnish them with gabions, fascines, and whatever other things they want. But when the first four are tired, the four last take their places, and work in the same manner, after which they are relieved by the first, and so alternately, till each has performed his part at the head of the sap.

When the first gabions are placed, and the sap is not as yet perfected, the part in which the gabions touch one another being less solid than the rest, their points are filled up by sand-bags, which are taken away when the work is completed, or those interstices are filled up with small fascines, called *sap-faggots*.

This is the nature of the sap; a work so much the more considerable, as it is performed by day as well as night. Several saps are carried on at the same time:

E

and

and there is one to both sides of each of the attacks for the second and third parallel. There are likewise saps to each of the advanced parts, and to the half-places of arms or parallels. The sap is paid by the fathom, and the price is advanced according as it becomes more dangerous. The lowest is forty sous, when it is very distant from the place; but it increases to twenty livres, and even sometimes more, when lodgments are made in the works of a town. The survivors of each brigade are paid for the work done by the whole; and if there was only one left, he would have the profit of all the rest.

We have supposed that the first sapper covered himself with a mantlet; this was the custom formerly, and an excellent custom; but now it is more usual to have a stuffed gabion. He rolls this gabion before him, and uses it in the same manner as he would the mantlet. Though care be taken to give a stuffed gabion to the directors of the saps, yet it happens sometimes that the sappers will not make use of them: for as the weight of this gabion renders it sometimes troublesome to roll, they chuse to do without it; and are satisfied with rolling several gabions before them, near one another, and with working behind them. These gabions are indeed of little defence, but are sufficient to conceal them from the enemy, who cannot tell the gabion, behind which the first sapper is. But as the preservation of these men is of great importance, they ought to be obliged to work behind the stuffed gabion: for the same reason the first sappers should have a cuirass, and even a head-piece musket-proof.

There are three sorts of sap, the *simple*, viz. that which we have been describing, the *double*, and the *flying sap*.

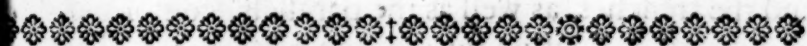
The simple sap, or the sap without any other appellation, is made on one side, or, which is the same thing, has only one parapet.

The

The double sap has a parapet on each side, and is carried on wherever its two sides are seen from the place.

The *flying sap* is that in which they do not give themselves the trouble of filling the gabions with earth; it is made where the workmen are not much exposed, and in order to accelerate the approaches.

The foregoing account, with the assistance of the figures relative to this subject *, is sufficient to give a very exact idea of whatever relates to the sap; we have only to observe, that as soon as the men have brought this work to its proper perfection, the pioneers are ordered forward, and these make it the same width as the other parts of the trenches, upon which it changes its name of sap to that of trench. It is called a trench, if it serves as a way to the town; and a place of arms, if it be parallel to it, and designed to lodge troops.



XII.

Of batteries.

AFTER having treated of whatever relates to the trenches; in order to follow the natural disposition of the attacks, it is time now to speak of batteries. It was proper to take notice first of the trenches, because no battery can be erected till the trench is advanced within reach of the cannon of the place, that is, within point blank, which is reckoned about 300 fathoms.

Cannon is made use of at a siege for two different purposes; the first to drive away the enemy from their trenches, and the second to dismount their guns.

To produce these two effects, the batteries should be above the mean reach of cannon-shot from the

* See Plate VIII.

place; that is, above 300 fathoms. Therefore there is no possibility of constructing them, till the first parallel is formed; and as the distance of this first parallel from the place is generally 300 fathoms, the batteries must be on this line, or beyond it, nearer the town.

In order to judge where they may be placed most conveniently, we are to consider that this must be where they are able to discover or see into a greater part of the enemy's defences. Now this can be no where but on the produced faces of the works attacked. In this situation they discover the whole length of the faces of those works, which they could not do in any other position; therefore we may lay it down as a general rule, always to place the batteries, when the ground will permit, on the produced faces of the works attacked, as we have mentioned in the maxims of attack.

Let Z (Plate IX.) be the center of the place attacked, and the trenches, as well as the parallels, completed. To find a proper position for erecting batteries, produce the faces AD, AC, and BE, BF of the two bastions attacked till their prolongation cuts the first parallel. Produce also the two faces OM and OL, of the half-moon MOL of the front attacked, and the faces HG and IK of the two collateral half-moons 1 and 2, to the first parallel, and erect batteries on these produced faces, as you see in P, Q, R, S, T, U, X, and Y.

They are advanced beyond the first parallel 40 or 50 fathoms, and are parted from the trenches, to the end that they may be used with greater ease and convenience, and less trouble to the workmen.

The construction of batteries belongs to the officers of the artillery, who consult with the engineer that has the direction of the siege, about their situation, and the number of guns.

To construct them, the ground they are to occupy being determined, an opening is made in the trench or place of arms, by which a sap is carried on, which

encompasses

encompasses the whole outward ground of the battery, after which its parapet is to be raised, pursuant to the explanation given Art. XI. of our treatise on artillery.

REMARKS.

1. That the batteries may be productive of their utmost effect, they must be parallel to the works of the town, which they are to batter.

2. The position we have given them being no more than 250 fathoms from the place, they are not only capable of driving the enemy from their defences, and of dismounting their cannon, that is, of breaking their carriages, but likewise to batter the opposite works of the place; therefore they may be left in this position during the siege, which will save the trouble and expence of a new construction. As the use of these batteries is only to drive the enemy from their defences, therefore the guns are fired *à ricochet* *. The *breach batteries*, and those to destroy the flanks of the bastions, are placed on the head of the parapet of the covert-way. It is hardly possible to place them any where else, so as to discover to advantage the flanks and other parts of the fortifications which they are to batter. There are only a few uneven grounds where batteries may sometimes be erected, to make a breach at a greater distance; and these when they fall in the way, and can be of any advantage, are applied to this particular use.

3. It is customary to place the bomb batteries and cannon batteries side by side, and in the same line, to the end that they may batter the same parts. The use of the former, as we have observed already, is to demolish the enemy's works, to dismount their guns, to penetrate into their powder magazines, and to drive them from their defences, as also to ruin the principal buildings, by setting fire to the town, and to fatigue

* See in the *Treatise of artillery*, the advantages of the *ricochet* firing, and in what they consist.

and distress the inhabitants, in such a manner, that they shall press the garrison to surrender, lest a longer resistance should cause the entire demolition of the place.

4. The cannon batteries are marked in the plans by a small parapet with embrasures, and the bomb batteries by a parapet without embrasures, within which are put a few cyphers to express the plan of mortars.

5. It is to be observed that the *ricochet* firing is never used, but when the enemy's *barbette* batteries on the flanked angles are dismounted. The cannon fired with their ordinary charge have a greater effect on these batteries, being more exposed by their elevation, than those which are fired *à ricochet*; the latter being intended to drive the enemy from their defences, but not to demolish them.

6. The batteries being all constructed, in the manner above mentioned, it is evident that they must drive the enemy from their defences, or kill a great number of men, if they continue in their posts. Thence it follows that the besiegers will advance in their trenches and saps, against which the enemy's fire will be greatly slackened, and not very dangerous.

7. Upon coming to the third parallel, it is usual to erect batteries of mortars, in order to incommode the enemy in the covert-way; these batteries may be also raised betwixt the second and third parallel.



XIII.

Of sallies.

THAT we might not interrupt the making of the trenches, we conducted them to the foot of the glacis, without taking notice of *sallies*, that is, attacks which the garrison may make against the trenches, with a view of ruining or retarding the works. As it is not to be presumed that the enemy will suffer themselves

themselves to be streightened in the town, without using some endeavours to prolong the siege, and as sallies seem to be one of the principal means they can employ, it is proper to point out the conduct to be observed, not only for preventing their effects, but likewise for rendering them disadvantageous to the enemy.

In the first place we are to consider that the garrison is always weaker than the army of the besiegers, and that the trenches are or ought to be guarded with such a number of troops, sufficient to make head against the whole garrison; therefore, if the besiegers keep a good look out, and do not suffer themselves to be surprized, there is no doubt but they will always be able to repel any attack of the enemy: to this let us add the disposition of the parallels, or places of arms, which keep firing on all sides against the town. Hence it is obvious that sallies can be hardly prejudicial to the besiegers; and indeed since the invention of parallels, they have seldom been productive of any extraordinary effect.

Marshal Vauban allows of two sorts of sallies, namely, *external* and *internal*; by *external*, he means those made by the enemy, when the works are yet at some distance from the place, and of course out of the covert-way; and by *internal*, those made by the enemy, when the besiegers have got footing on the covert-way. Here we mean to speak only of the former; the latter merit rather the name of attacks than sallies, considering that the besieged need hardly stir out of the place upon such occasion, and that the very moment they go out of their own works, they fall upon those of the besiegers.

The intent of sallies is to destroy a part of the trenches, to get to some battery, in order to nail up the cannon, or to surprize part of the guard in the trenches. When there happens to be a strong garrison, they likewise make sallies without any particular view; but a sensible governor will avoid all such, and we are to suppose, that he acts always with

one settled design, which is to retard the taking of the place, otherwise he would wantonly expose the garrison, and be the cause of knocking men on the head, without any sort of necessity.

Sallies can be attended with no success, according to what hath been already observed, unless they are made at a time when unexpected; by falling then upon the workmen, they are scattered, and obliged to fly. They in running away must needs occasion confusion and disorder among the troops that are to support them; and it requires some time before they can be brought again to order, and made to charge the enemy. In the mean while the latter avail themselves of the opportunity to fill up the trenches, and to do all the mischief possible: but when the troops are upon their guard, against every design of the enemy, if the latter stir out of the place, they are suffered to advance, and care is taken to cut off their retreat, by means of the cavalry and the picket*, in case they should advance too far into the field; otherwise they are fired at from the places of arms, and the other works within reach; and then they are briskly attacked by the grenadiers, and the troops upon duty in the trenches. Care, however, must be taken not to pursue them too far, for fear of the fire of the place, which never fails to be extremely sharp, when the enemy have got back to the covert-way.

In proportion as the works advance towards the town, sallies become more dangerous to the besiegers, because the enemy may fall upon the trenches more readily, and retire into the town with more ease and safety; for which reason double care should be taken to streighten them more closely, and to prevent their falling out with impunity. As the works carried on

* A picket is a certain number of soldiers of several regiments, ready to fly to their arms at the word of command; they are relieved every 24 hours.

beyond the second parallel are more exposed than the rest, because of their proximity to the covert-way, no part should be advanced without being well supported. Hence, as we have already taken notice, half-places of arms are formed, in order to support the head of the trenches, till they reach the third place of arms, which must be set about with the greatest care and expedition possible. When this is done in the manner it ought, there will hardly be any further danger from the sallies.

Sallies are seldom made in the day-time, but by a presumptuous enemy, who imagine they may safely attack and defy the troops on duty in the trenches; but they are easily repulsed, unless the besiegers are so weak, as not to be able to furnish a sufficient guard for the trenches; in which case they ought not to continue the siege, lest they run a risk of being at length intirely defeated.

A garrison may likewise be in a condition to insult or attack the trenches, after having received a strong reinforcement; and then it is in the option of the general either to continue or to raise the siege. If it appears that his army suffers too much by continuing, he ought to raise it: but here we suppose that he has all the superiority of troops necessary for avoiding such a step, which independently of the expences incurred in preparing for the siege, and the number of men slain in the different operations, is generally attended with very troublesome and disagreeable consequences.

At the first opening of the trenches, and when the besiegers are at a good distance from the place, there is little occasion to be afraid of any sallies in the day, for there would be full time enough to prepare to receive them, before they reached the works. If the enemy are disposed then to issue forth, they will do it by night; but it will be an easy matter to get intelligence of any attempt they should make, by ordering parties of 10 or 12 men, headed by a serjeant, to range in the night between the trenches and the town.

These

These men may lie on their faces as near the place as possible, remaining in profound silence till they hear or perceive some motion in the covert-way; then they should send one of their own body immediately, to acquaint the lieutenant general who that day commands the trenches, and the rest should continue there as long as they can be concealed, to see which way the enemy direct their course. This caution is not only simple and easy, but sufficient to guard the besiegers against surprize, and to enable them to give a warm reception to the enemy.

When the works are advanced pretty near to the place, for instance, to the third parallel, if the enemy should then sally out and fall upon the workmen, the latter must be ordered to retire quickly to the back of the third place of arms, and let the guard fire briskly upon them, without minding the overturning of a dozen or two of gabions; for the galling fire of the small arms, to which the enemy are exposed during this expedition, will make them pay dearly for what little disorder they occasion. While they are taken up in this business, the besiegers must fall upon them vigorously, and drive them back into the town, taking care however not to follow them too far, for fear of being exposed to the whole fire of the place, as soon as the enemy is got back to the covert-way. The mischief they have done is quickly repaired: Marshal Vauban says that one hour is enough for this purpose; and if the fire of the besiegers has been well served, it does more harm to the besieged, than that they can have done to the trenches.

XIV.

Of the lodgment on the glacis, and the taking of the covert-way.

WE left the works at the foot of the glacis, and at the third parallel, our business is now to make a lodgment there, and to go on with them till we have driven the enemy from the covert-way.

Our being then so near the covert-way, renders it impossible to defile from it; but in order to prevent the effect of enfilading, it is necessary to make the trenches much deeper in the glacis; the fire of the covert-way being very near, cannot plunge into these deep trenches, which renders it less dangerous to abide there than it would otherwise be, were it not for this precaution: or they are made with traverses, much in the same manner as in the covert-way, by which means the enfilading will be prevented in part, though not entirely.

And here we are to observe, that the enfilades are far less dangerous when near than at a distance; because it is easier to guard against them by means of traverses. When near, the violence of the fire makes the ball describe a line sensibly direct; so that if it grazes the top of the parapet of one traverse, it will plunge into the next. But in distant enfilades, the balls being at the end of their reach, and having spent their force, they describe lines sensibly different from direct; so that in spite of the traverses and their height, they fall into the part of the trench between the traverses. This is a remark made by M. Vauban.

In regard to the figure of the lodgment on the glacis, it varies according to the different circumstances or position of the works by which it is defended. The common way is to make several short turnings or zig-zags upon the ridge of the glacis, in the direction of the salient angle of the covert-way, and continued to this angle; or you begin with making two or three short

short turnings towards the foot of the glacis, from whence you ascend afterwards by a direct trench, or sap, in the following manner.

Two sappers roll each a mantlet, or stufft gabion, before them on the ridge of the glacis, each making a sap, one on one side of the ridge, and the other on the other. The ditch is dug deeper than usual, in order to cover them the better against the fire of the place. This work, which advances on both sides at the same time, and both sides covered, each with a parapet, is what we called a *double sap*. In the middle they make traverses three fathoms thick, and of the same breadth as the trench. On each side small passages are made, like those overagainst the traverses of the covert-way; to the end that the communication thereof be not interrupted.

These traverses are constructed so near to each other, as to be a sufficient cover, by their elevation and distance, against the fire of the place. In order to guard against the effect of the grenades, upon coming within their reach, that is, within 14 or 15 fathoms of the covert-way, care then is taken to cover this trench with blinds, or, which is the same thing, to cover the upper part of it.

The first and second figures of the tenth plate will shew this direct trench. The first exhibits the plan, and the second the profile, which passes over one of the traverses.

All this being done, and the third parallel finished in the manner we supposed, they advance from this parallel upon the glacis to each of the saliant angles of the covert-way of the front attacked, and they begin with making two or three short turnings, as marked on Plate XI. Fig. 1. along the ridge of the glacis, so as to occupy about one third thereof. These are to be made as deep as is necessary, to be a shelter against the fire of the covert-way; afterwards they may proceed directly along the ridge of the glacis, by a deep ditch, to the saliant angle of the covert-

covert-way. M. Vauban observes, that if we follow directly the ridge of the glacis, this trench is made without much danger. For the palisade which is placed at the salient angle of the covert-way, and the other two next it, do not present directly to the ridge, but only opposite to the faces; where at the most there is only room for one or two fusileers to see the head of the trenches, and who are easily silenced by the fire of the third parallel, which ought to be well served, and likewise by that of the *ricochet*.

Upon coming to the middle, or two thirds of the glacis, two new saps are made, *b b*, Plate XI. Fig. 1. which embrace both sides of the covert-way, to which they are almost parallel. Their length is 18 or 20 fathoms, and about five in breadth. They are covered at the end with *crochets* and winding traverses, which prevents the fire of the covert-way from enfilading them easily.

The parapet of these saps is raised about eight or nine feet above the glacis; and by means of gabions, three banquettes are made, as may be seen in Plate XI. Fig. 2. The soldier placed on the upper banquette is thereby raised high enough to plunge into the covert-way, as appears from the same figure. When this work, which Marshal Vauban calls the *Cavalier of the trench*, is once finished, it is very difficult for the enemy to remain any where in the covert-way; for they would be too much exposed to the fire of the soldiers placed on these cavaliers. But these places of arms or cavaliers cannot be made without being protected by the *ricochet* batteries, which enfilade the covert-way.

There is also another method, mentioned by us in our Treatise of artillery, of driving the enemy from the covert-way, which is by using the *ricochet* bombs. The confusion and mischief they occasion in this part of the fortifications, plainly shews there is no possibility for the enemy to maintain themselves there, so long

long as this method is practised; as we have observed in the abovementioned treatise.

These cavaliers being once finished, it is easy to carry on the direct trench, as far as the saliant angle of the covert-way, and to establish at the point of this angle and on the head of the glacis a small lodgment bounded by a circular arc; whence the enemy may be entirely driven from the saliant place of arms of the covert-way. Afterwards this lodgment may be widened on branches of the covert-way, by digging into the upper part of the glacis, at the distance of three fathoms from the inner side of the covert-way; to the end that this thickness may serve as a parapet to the lodgment, and skreen it from the cannon.

The operation we have been describing, to reach from the third parallel to the saliant angle of the covert-way, is formed at the same time against all the saliant angles of the front attacked: hence the enemy is obliged to abandon them almost all at the same time; and the lodgment on the glacis is afterwards advanced on both sides of these angles, towards the re-entering places of arms of the covert-way.

As it is impossible to make this lodgment defile from the works of the place, there is no other way to guard against the enemy's fire than by many traverses. The 5th figure of the 10th plate shews in great, the plan of part of this lodgment with its traverses; which are made with chandeliers and gabions. If the enemy, notwithstanding the cannon and bomb-batteries *à ricochet*, and the fire of the cavaliers of the trenches, should obstinately continue in the re-entering places of arms of the covert-way; now in order to compel them to remove, batteries for throwing of stones are raised over against those places of arms; and with this view, as soon as the lodgment of the glacis is brought within one half or two thirds of the branches of the covert-way, on both sides of the re-entering angle a sap is carried on opposite to the place of arms; and on this sap

rap batteries for throwing stones are erected, as may be seen in *cc*, Plate XI. These batteries being finished and ready to play, they discharge a shower of stones into the place of arms, (Plate XI. Fig. 1.) which will not suffer the enemy to maintain themselves there any longer. The lodgment continues to advance, and as soon as the enemy is driven from the place of arms, it is continued all round the faces thereof: and a lodgment is likewise made there, which must communicate with that of its faces; and should extend almost circularly along its demi-gorges. This lodgment being properly finished, will hinder the enemy from venturing to return to the covert-way; and of course will secure the possession of it to the besiegers. These lodgments are made with gabions and fascines; the gabions are filled with earth, fascines are put over them, and the whole is covered with earth; they sink into the glacis as deep as is requisite to be covered against the fire of the place.

In the whole of this account we have not made use of mines; because we were willing that the description of the works, which are carried on from the third parallel, in order to become masters of the covert-way, should be as plain as possible. This omission we shall now supply, by making mention of the principal difficulties occasioned by mines, in endeavouring to drive the enemy from the covert-way.

Without mines the enemy would find it very difficult to retard the works we have been describing; because the *ricochet* batteries must gall them excessively, and break up their defences, so as to deprive them of all shelter: but they may have some resource left in works under ground, where their miners can proceed with more safety; while those of the besiegers, not having the same knowledge of the ground, can only grope in the dark; so that it is altogether a mere chance if they find out the enemy's galleries, and succeed so as to destroy them. If information is received that

that the glacis is countermined, there can be no manner of doubt but the enemy will avail themselves of their countermines, to carry branches forward into the field; and then to avoid, as much as possible, the mischief that may be done by those subterraneous fires, in the third parallel shafts or pits are sunk eighteen or twenty feet deep, if the ground will permit, in order to get below the galleries of the besieged: and from thence galleries are carried on towards the covert-way, to meet with those of the enemy, boring the earth with a long iron needle or augre, to find them out. If they are found underneath, an opening is made down into them, and shells are thrown in, to drive away the enemy and to ruin their gallery. If on the contrary they are to be found above them, a small mine must be sprung, to break them; but if none of the enemy's galleries can be found, in that case branches must be carried to the right and left; at the end of which are made small chambers, to shake the neighbouring ground, which can hardly miss destroying the galleries and chambers of the besieged.

Notwithstanding all the care that can be taken in the like case, it is not to be presumed that the mines of the besieged under the glacis should be rendered absolutely ineffectual; but as soon as any of them are sprung, workmen are immediately sent to make a lodgment in the pits. In some grounds, the mines of the besieged may be spoilt, by letting in a brook or rivulet into the galleries; for which purpose you have only to dig pits in the neighbourhood, and let the water run in. This expedient was made use of at the siege of Turin in 1706, whereby a great many mines of the besieged were rendered useless.

The enemy should have mines placed, to hinder the lodgment on the head of the glacis, within four or five fathoms of the palisades of the covert-way; to the end that in springing them the palisades may not be hurt,
and

and that they may be under the lodgment which the besiegers make there.

When they have sprung their mines, they make lodgments in them; the besiegers likewise on their part spring mines, with a view to destroy the palisades. In short, nothing is neglected on either side that can help to destroy one another. The besieged do not give up an inch of ground without disputing it manfully; and the besiegers employ every method in their power, to oblige the enemy to yield as soon as possible, and with as little loss of men as may be.

Nothing can be said but what is very general on this sort of contests. They depend on the situation of the ground, and upon the capacity and understanding of those who attack, and those who defend the place.

Before we made mention of mines, we supposed, when treating of the lodgment on the top of the glacis, that the fire of the cavaliers of the trenches, together with the cannon and *ricochet* bomb batteries, had obliged the enemy to quit the covert-way; but if notwithstanding these fires, they should obstinately continue in the places of arms and behind the traverses, the way to drive them entirely from thence, and to make the lodgment we have been speaking of upon the glacis, is as follows.

Whether the enemy has sprung a mine near the salient angle of the covert-way, or whether the besieged have blown up some of the palisades near it, as soon as the mine is sprung, workmen must be sent to the excavation; where they are to cover themselves with all possible expedition, and afterwards to extend their lodgment in the covert-way on both sides of its salient angle.

The double trench, or the double sap on the ridge of the glacis, must be made to communicate with this lodgment, in order to be able to sustain it, if there should be occasion; and to communicate with it more safely. Particular care must be taken to cover the extremities of it, that is, to make traverses every
F where,

where, in order to be shelter'd from the fire of the other parts of the covert-way, where the enemy still maintain themselves.

When this lodgment is extended to the first traverses of the covert-way, if the enemy keep their ground behind it, as there can be but few under cover there, considering the space they have to occupy, a company of grenadiers must make a brisk attack to drive them away: this done, some of those grenadiers should endeavour to find out in the part abandoned by the enemy the entrance into the mine, and the saucisson; and upon finding it, as there is great probability that they will, they are to cut it off, and thereby render the mine useless*. Workmen may be likewise sent into the passage round the traverse, and there make a small lodgment, which will be the safest that can be contrived, when the enemy is so very near. After this an entrance is to be dug in the covert-way opposite those traverses, and continued towards the bank of the ditch, under cover of the traverse; then a sap is to be made from each of the extremities of this passage, that is, near the border of the counterscarp; which are to be carried along the rounding of the counterscarp, towards the middle, where they are to meet. This lodgment must be made very deep, that it may be no hindrance to that on the head of the glacis; and it is to be managed so as to leave between it and the border of the ditch a breadth of earth, sufficient to resist the cannon of the flanks and the curtain. This lodgment must be also covered with blinds, to prevent the effect of the grenades; and it is of great use towards an opening into the ditch.

During the whole time that the besiegers are working upon this lodgment in the interior part of the covert-way, they are to continue the lodgment on the top of the glacis, as far as the re-entering places of arms; from whence the enemy may be driven by or-

* See Plate XI.

dering a few companies of grenadiers to attack them, supposing they should be so obstinate as to continue there, notwithstanding the fire of the *ricochet* batteries, and of the shells and stones. As soon as the enemy have entirely withdrawn themselves, a lodgment must be made there, as we have already mentioned.



XV.

Attack of the covert-way, sword in hand.

THERE is another method of driving the enemy out of the covert-way, more expeditious indeed, but at the same time more bloody, more precarious, and infinitely less skilful. This consists in making a sudden attack on the whole front of the covert-way, in driving the enemy from thence by main force, and afterwards making a good lodgment.

There may be circumstances that shall absolutely require this method of attacking the covert-way; as when there is no possibility of erecting *ricochet* batteries to fire at its branches, nor at the faces of the works in the front of the attack; or when it is presumed that the enemy are not in a condition to withstand an attack of this sort; or, in fine, when it is thought expedient to run any hazard in order to be masters of the covert-way a few days sooner; on such occasions it is usual to take this method of attacking which is conducted thus.

When the resolution is taken to attack the covert-way sword in hand*, the third parallel should be made to advance as near as possible to the glacis; and the more forward it is brought, the safer the attack. All along this parallel banquettes are to be made, step-fashion, to the top of its parapet, that the troops designed for the attack may pass over it with ease. At the back of

* See Fig. 4. Plate VII.

this line, and in the very line itself, a great quantity of materials, as tools, gabions, fascines, sand-bags, &c. must be got ready, that nothing may be wanting to make the lodgment with all expedition, after driving the enemy out of the covert-way. A strong party of grenadiers is ordered, and placed along the third parallel, four or six deep, and the workmen behind them on the back of this parallel with their tools, gabions, fascines, &c. Care, moreover, is taken, that all the other parts of the trenches be well furnished with troops to support the grenadiers, if there should be occasion; and to fire at the enemy's defences, wherever they appear: the grenadiers must also be provided with hatchets, to cut down the palisades of the covert-way.

The guns and mortars must be ordered to be ready to support the attack with their whole fire.

A signal is to be agreed on for all the troops that are to commence the attack, to move at the same time, and to fall upon the enemy.

This signal is to consist in firing a certain number of cannon, or a certain number of bombs, and at the last cannon-shot, or at the last bomb, the troops are to move.

The signal being given, all the troops of the third parallel are to move at the same time, and to pass quickly over the parapet of the parallel, and to march directly to the covert-way, which they enter either through the sally-ports or passages made by the guns, or else the grenadiers cut down the palisades with their hatchets. As soon as they have entered, they charge the enemy vigorously; and when they have obliged them to abandon some of the angles, the engineers set the workmen about making a lodgment on the ridge of the glacis, opposite to that part of the covert-way which the enemy have abandoned, and within three fathoms of the inside of it. This lodgment, as I have observed, is made with gabions, which workmen lay on the glacis on the side of one another. The joints

joints are covered with sand-bags, or with sap-faggots. These gabions are filled with earth and covered with fascines, and atop of all you are to throw earth taken out of the glacis, by digging and widening the lodgment; and of this a parapet is raised to screen the troops as quick as possible from the direct fire of the place, and traverses are to be made every where to prevent the enfilades, as may be seen in Plate X. Fig. 5. While this is doing, the batteries of the trenches are to fire incessantly upon the defences of the place, in order to disturb the enemy, and to abate, as much as possible, the briskness of their fire upon the workmen and the lodgment.

When the troops employed in the attack have driven the enemy from the covert-way, or from their places of arms; for it often happens, that at the first attack there can be no more than one or two lodgments made in the salient angles; when this is done, I say, the troops retire behind the lodgment, where they kneel down till it is in a condition to cover them. Sometimes it shall happen that the enemy, who was supposed to have been driven from the covert-way, will return to the charge, and oblige the besiegers to renew the attack, by overthrowing the lodgment and falling upon the troops unawares. This attack may be renewed several times, and vigorously disputed, when there happens to be a strong garrison. In this case the besiegers must exert their bravery, and resolutely encounter every obstacle raised by the enemy.

When the besieged find they cannot hold out any longer, they will set fire to their mines and retire; upon which, workmen are sent to make a lodgment in their excavation, as we have already observed when speaking of this attack by the sap. In short, the besiegers are to struggle against every difficulty with all their might; and if they happen to be repulsed at the first attack, they are to begin it again the next day or the day after, and they are to use more precaution than the first time for securing their success.

Before this attack is begun, the besiegers must make a brisk cannonading against the covert-way, in order to break down the palisades, and to demolish the ridge of the glacis, so as to render it easier for the troops to force their way and to make a lodgment upon it. When this is done, the necessary time is to be given for the pieces to cool, that is about an hour, and the attack is to begin in the manner above mentioned; during which the artillery is to play incessantly.

It must be allowed that this manner of attacking is very bloody: for the besiegers must move almost the whole breadth of the glacis uncovered, and exposed to the whole fire of the place. They are obliged to attack the enemy concealed behind the palisades, which they are to cut down with hatchets before they can come at them. They are to fight for a long while to an evident disadvantage; and when by dint of valour they have driven away the enemy, they find themselves exposed to the whole fire of the ramparts, which on that occasion is served with more vivacity than usual. They are likewise exposed to the mines which the enemy blow up, with a view to disconcert the lodgment, and to throw the troops into disorder and confusion, which renders it easier for the besieged to return to the charge, and harass them anew. But the former method, of which we have above treated, is far from being so precarious and bloody. According to M. Vauban, we ought ever to prefer it when in our power; and to make use of the latter, only when we are obliged to it for essential reasons.

Night is the best time for this attack, because the besiegers are less seen from the place, and of course the fire of the besieged is less dangerous: yet there are generals who undertake it by day. There is nothing settled in regard to this article; they are at liberty to act as they judge most proper, according to the circumstances of time and place.

XVI.

Of the batteries on the covert-way.

WHEN the enemy are entirely driven out of the covert-way, the next thing to be done is erecting batteries, in order to ruin the defences of the place and to make a breach.

As it is necessary for the besiegers to make themselves masters of the half-moon C (Plate XI. Fig. 1.) before they can come to the body of the place, which is flanked or defended by part of the faces of the bastions A and B opposite to its ditch; they must begin with erecting batteries on the covert-way opposite those parts. They are marked on the plan *e, e*. Batteries must be also erected to make a breach in the half-moon. But before they are erected, it will be proper to consider what part of the face of the half-moon is to be attacked; or which is the same thing, at what part the half-moon is to be entered. It must not be at its flanked angle, because an opening towards the point would not afford a sufficient space to make a lodgment able to withstand the enemy; and moreover the troops would be seen in their passage by the two faces of the bastions, by which its flanked angle is defended. The most favourable passage is towards the third part of its face, reckoning from its flanked angle, because by battering at the same time the two faces near this part, the whole point of the half-moon may be destroyed, and a large opening made there easier than any where else. Thus the batteries for making a breach in the half-moon C, will be placed in *d* and *d*, and will occupy almost the third part of each of the faces of the half-moon from its flanked angle. These batteries are each to consist of four or five pieces of cannon.

When the faces of the bastions A and B (Plate XI.) are well enfiladed by the *ricochet* batteries, there will be no occasion for the batteries *c* and *e*; for those

which are to batter the half-moon in breach, will be sufficient; and after it is taken, if there is any necessity for ruining the faces of the bastions A and B, you may make use of the batteries *d* and *d*, by placing them in *e, e*. Batteries must also be erected to ruin the flanks of the demi-bastions in the front of the attack. It is evident that they cannot be placed but in *i, i*, on the covert-way opposite to them. They ought also to contain as great a number of guns as the space of ground will permit.

For the same reason that batteries have been erected to make a breach in the half-moon, opposite the third part of the face joining to its flanked angle, those also are to be erected which are to make a breach in the bastions; they are marked *b, b*, and are each of seven or eight pieces of cannon. Batteries are likewise erected to ruin the flanks of the demi-bastions bordering upon those of the front attacked, in order to favour the passage over the ditch which is made on the side, upon a supposition that the bastion is entered at both faces, as we suppose in this example. The attacking both faces of the bastion, renders the taking of it more certain and easy; but, generally speaking, it is looked upon as sufficient to make only a breach in the face of each of the demi-bastions towards the front attacked.

Besides all these batteries, others are erected in the re-entering places of arms of the covert-way, as in *k*, and in *k*; they serve to batter the *tenaille* when there is one, the curtain, and the faces of the bastions, &c. Sometimes they are of mortars for throwing of stones.

All these batteries should have twenty-four pounders; sometimes larger pieces are used, especially when there is any work of extraordinary strength and solidity to be demolished.

They are all to be placed on the parapet of the covert-way; and the outside of their epaulement is to graze the inside of the covert-way. It is in order to have room enough for this epaulement, that the lodg-
ment

ment is made on the ridge of the glacis at the distance of three fathoms from the inside of the covert-way.

The only essential thing to be observed in these batteries, is to open their embrasures, so that they shall perfectly discover every part of the place they are to batter, and have a sufficient sloping from the back to the fore part, to fire as low as the bottom of the revetements, which they are intended to destroy. It is also proper to prevent the enemy's blowing them up with mines: for this end it will be requisite to dig wells deep enough round the batteries, so as to be sure of being lower than the enemy, and to make small galleries round the batteries, in order to discover the branches the enemy have underneath to blow them up.

As the construction of this sort of batteries is very dangerous, being absolutely to be made under the fire of the rampart of the place, they are sometimes masked, that is, before the part where they are erected, sand-bags, or some other materials are placed, with a view to shelter the workmen from the enemy.

In order to batter in breach, all the guns should fire together, and towards the same part. They should fire as low as they can, and continue to batter the same part, till the earth of the rampart behind the revetement begins to fall, which is a sign that the revetement is intirely destroyed. This united firing, repeated in this manner against the same place, is productive of a much better effect, than if the guns were to be fired one after the other; for not only a greater quantity of the wall is shaken at the same time, but, moreover, the shaking is far more considerable.

XVII.

Of the descent, and passage over the ditch of the half-moon.

WHILE the batteries on the covert-way are erecting, preparations are made for the descent and passage over the ditch of the half-moon.

The ditches are either dry, or filled with water, which may be either stagnated, or running; and even into dry ditches the enemy may let in water, only opening the sluices by which it is withheld.

Each of these sorts of ditches requires a different manner of passing. We shall enter here into such particulars as are most necessary for giving a right idea of the method of proceeding.

First of all, if the ditch be dry, and very deep, as from 25 to 30 feet, the descent may be made by one or several subterraneous galleries, passing under the covert-way, and terminating at the bottom of the ditch: the entrance is to begin about the middle of the glacis. These galleries are made like those of miners, and the earth is supported by boards and timber frames. They are directed in such a manner, that the opening in the ditch shall be opposite to that part of the breach, where the passage is intended.

As this gallery is made sloping, the business is to have some rule for directing the slope, so as to prevent its being too small, or too great: too small, if it terminated above the bottom of the ditch; and too great, if it terminated below it.

The following is a most simple way to find it out: first of all, it is requisite to take the depth of the ditch, which is done by letting fall a plummet, with a string tied to it, from the border of the covert-way, to the bottom of the ditch. It is requisite also to know the distance from the entrance of the gallery to the border of the covert-way, which may be easily measured thus:

I

Suppose

Suppose the depth of the ditch is 30 feet, and that the distance from the entrance of the gallery to the border of the ditch is 90 feet, then by advancing six feet towards the counterscarp, the slope must sink two; that is, there must be always the same proportion between the length of the passage made to approach the counterscarp, and the depth of the slope, as between the distance from the entrance of the gallery to the border of the counterscarp, and the depth of the ditch; so that if the distance from the entrance of the gallery to the border of the counterscarp is four times as much as the depth of the ditch, then for every four feet advanced horizontally towards the ditch, there must be one sunk perpendicularly, &c. When the ditch is not deep, as of 12 or 15 feet, instead of a gallery under ground, the descent is made by a sap only, which cuts the parapet of the covert-way, and sinks therein as deep as is necessary for the descent to terminate at the bottom of the ditch. This sap must begin at the lodgment on the ridge of the glacis; it is secured on both sides with blinds, to support the earth, and it must have a good epaulement on the side exposed to the place. Above it is covered with fascines and with earth, to avoid the shell-stones and granades, that may be thrown in by the enemy. Upon advancing to the foot of the counterscarp, an entrance is made into the ditch.

The enemy will use all their endeavours to hinder this entrance, and to ruin the gallery, chiefly by making small sallies to drive away those who are employed in constructing it: but they must yield at length to numbers. The passage is continued with sapping, to gain the foot of the breach, and by raising an epaulement of fascines, barrels, or old casks, gabions, &c. towards the face of the bastion opposite the passage.

There are generally two or three descents made for the same passage of the ditch, near enough to support each other for greater safety.

It

It is in the passage of the dry ditch that the enemy has the advantage in making use of various artifices to retard it. In these they are chiefly assisted by their miners, who blow up the saps by means of small mines, and fall out at the same time, neglecting nothing that can delay the progress of the work. They may likewise order 12 soldiers to fall at once upon the head of the sap: this number is sufficient to drive away the sappers, and to do some damage to that work. A few companies of grenadiers should be placed near at hand, to attack these men as soon as they appear, and the cannon must be kept continually firing against every part, from whence the enemy may possibly fall out. As the batteries of the covert-way command all their communications, they may destroy them, or at least render them very dangerous.

In order to protect the sap at the bottom of the ditch, the besiegers may likewise make use of a kind of small galleries behind the counterscarp, near the place where the entrance is effected, and they may pierce some loop-holes, from whence the enemy may be fired at, and a check put to their sallies, at least by day: and in regard to night, the besieged ought to be more circumspect than by day, since they can neither see the dispositions, nor the troops that are ordered into the ditch to support the sappers; so that they can only raise a false alarm, without doing any great mischief. Yet we must observe, that this passage can be made only so far as it is protected by the battery, placed on the ridge of the parapet of the covert-way, opposite the ditch: for as the cannon of this battery keeps continually playing against the defences of this ditch, they must ruin them of course, and destroy their parapet, so that the enemy shall no longer be able to keep any cannon there; the consequence of which will be, that the besiegers have only to screen themselves from musket-shot, which is an easy matter.

The passage of the ditch is made on each side of the faces of the half-moon, as may be seen in *m, m*,
Fig. 1. Plate XI. If

If the ditch is full of standing water, and the surface of it be raised to three, four, or five feet, below the upper border of the counterscarp, the descent will be easier, because as the steps are to have but a very small slope, they may begin nearer the border of the ditch, as in the lodgment on the ridge of the glacis, and be directed in such a manner, as to terminate at the surface of the water. They are to be covered on the side exposed to the place, and strongly secured with blinds, placed within five or six feet of each other. Blinds are likewise to be laid over the descent, which is to be covered with fascines, and these with earth, to prevent the enemy from setting them on fire.

In order to pass this ditch, a bridge must be made with fascines; for which end, after breaking the counterscarp, a number of men, sufficient to occupy the whole length of the descent, are ranged at the distance of two feet from each other: these men must be covered by the parapet, and are to forward the fascines from hand to hand, from the head of the passage to the opening into the ditch. The sapper in this part (for all these works relate to the sappers) will throw them into the ditch, in order to make an epaulement or covering on that side of the town, which looks towards the passage.

As soon as he has flung in a sufficient number of fascines to shelter himself, and to advance a few paces into the ditch, he must throw a great number of them into the passage, in order to fill the ditch up intirely in that part. They are laid different ways, and ranged in different beds, which are covered with earth, in order to make them sink to the bottom. All these different beds of fascines must be fixed with long stakes, that they may keep closer together; and as the work advances, the parapet must be pushed forward, otherwise it would be impossible to effect the passage without the utmost danger.

When the passage is commanded, or fired into from the opposite parapet of the place, or from any other part,

part, the foremost men must be covered with a great heap of fascines, or by some other contrivance; but whatever cover it be, in that case the passage of the ditch is extremely difficult and dangerous.

After what has been said concerning the passage of dry ditches, and those which are full of standing water, it remains to take notice of those which are full of running water, and those that are dry, but may be filled at any time with water. These sorts of ditches are extremely difficult to pass, unless the current can be turned, and made to take a different course from that which carries it to the town ditches; or unless the besiegers can contrive to break down the sluices, which keep up the water reserved by the enemy for filling the ditch.

A great deal might be said, were we to enter into the whole detail of the works necessary for passing these sorts of ditches; we shall only touch upon the subject.

Supposing the ditches to be filled with running water, or with a river, the channel of which can be diverted no other way, which is called *draining the ditch*, it will be requisite then, generally speaking, to throw into the ditch a large quantity of fascines, loaded with earth and stones, fastened together with long stakes; thus the passage is to be pushed on, till the ditch is contracted to the breadth of 20 or 30 feet, and then small beams may be laid across, to join the bridge of fascines to the rubbish of the breach. The filling up, and consequently the passage of the ditch, may be also forwarded, by ordering the miners to advance to the rubbish, and to spring a mine, in order to blow up part of the revetement of the work into the ditch.

Should the enemy happen to have reservoirs of water which they may open, and thereby destroy the lodgments in the ditch, when they are no longer to make a stand there, the besiegers must endeavour, during the siege, to destroy the sluices, that is, the stone work, or timber, that serves to keep up the water.

This

This may be done by throwing a great number of bombs towards that part where the sluices are known to be situated; if they should be broke down by that means, then the water will have a free current, and after it has run off, the passage of the ditch must be attempted in the same manner, as if it was standing water; if there remains only a very small current, a passage must be left to drain it, as was mentioned before.

This whole operation is very tedious, difficult, and dangerous; nay, it is impossible to be done at all without being protected by a very brisk firing, not only from all the cannon of the covert-way, and the ricochet batteries, but, moreover, from the lodgments on the glacis, and those on the covert-way.

Whatever has been said concerning the passage over the ditch, is general, as well in regard to the ditch before the outworks, as that before the body of the place.

We supposed the ditches had a revetement, but if it was otherwise, the passage would be easier. The descent might be made along the slope of its counter-scarp, and the ditch might be afterwards passed over, in the manner already mentioned.

In this whole detail, we have made no mention of *cunettes*, a kind of small ditch, three or four fathoms in breadth, always filled with water, which is sometimes made in the middle of the great ditch: the reason of our being silent upon this article is, because it can hardly increase the difficulty of passing the ditch. As soon as the besiegers reach the border of the cunette, they throw in fascines to fill it, as into a ditch full of water; being but narrow, it is the more easily filled up. The difficulty of the passage is increased only, when there are caponiers in the ditch to command and enfilade it: then to make the passage of the cunette, the enemy must absolutely be driven from those caponiers. This may be done by showers of shells and stones thrown from the lodgments on the covert-way.

The

The 12th and 13th plates will illustrate all that we have been saying upon this head, touching the descent and passage over the ditch.

The *first figure* of the 12th plate exhibits the plan of the descent under ground, and that of its opening into the dry ditch. The *second figure* represents the profile of that descent, the opening of which is made at the lower part of the ditch. The *third figure* is a perspective view of the opening of this descent, seen from the bottom of the glacis; and the *fourth figure* shews in perspective the opening of the same descent, seen from the top of the breach.

The *first figure* of the 13th plate is the plan of the passage over a wet ditch, in the open air; that is to say, the gallery of which is an open sap. A is the opening of it. You see in B, towards its opening, the blinds that are laid on its upper part, to support the fascines with which it is covered. On these blinds, at first, is laid a bed of fascines, ranged according to the length of the gallery: over this first bed is laid a second, wherein the fascines are ranged according to the breadth of the gallery, as you see in B and C. D is the epaulement of fascines, which covers the passage against the fire of the place, by which it is flanked. E is part of the bridge of fascines; and F is an elevation also of fascines intended to cover the head of the work, and to secure it from the immediate fire of the place.

The *second figure* of the 13th plate represents the profile of this descent into the ditch.

The *third figure* gives its opening seen in perspective from the country; and the *fourth figure* its opening into the ditch, also in perspective, as it appears from the top of the breach.

XVIII.

Of the attack of the ravelin, or half-moon.

THE passage over the ditch before the half-moon being effected on both sides, and a breach made 14 or 15 fathoms wide, preparations are made for the assault. For this purpose a large quantity of materials is collected from all the neighbouring lodgments. Endeavours are used to render the breach practicable, by making the slope easy. The cannon continue playing, in order to throw down the parts of the revetement that may be yet standing. Very good use may be also made of shells fired point blank; for they are easily buried in the breach, the earth of which has been already broke up and shaken by the cannon; and as they burst upon that earth, they produce the effect, as it were, of small mines. Howitzes may likewise be used with success on these occasions.

In order to render the breach more practicable, some miners, or a serjeant with a few grenadiers, are sent to level it with hooks. The fire from the lodgments and batteries will hinder the enemy from appearing on their defences; or if they should, they must do it with great circumspection, which renders their fire less dangerous.

If the enemy have made any galleries along the face of the half-moon, and opposite the breaches, the miners may go and discover them, in order to stop them up, or to cut off the match, or to drive away the enemy; if they cannot find them, they spring several small mines, which being often repeated, must needs occasion some disorders in the galleries and mines belonging to the besieged. Every thing being ready for making a lodgment in the half-moon, that is, for taking possession of the breach; the materials being at hand, in order to be removed hither with ease and expedition; the batteries and lodgments of the co-

vert-way being in a condition to fire away briskly, a signal is agreed upon with the officers that command those batteries and lodgments, to give them notice to fire, and to leave off whenever it is thought proper. This signal is generally a flag raised in the former case, and lowered in the latter. All this being settled, and the breach, as we observed, made practicable, two or three sappers are sent to the extremity of the breach next to the place, there being generally a kind of small cover, or cavity, in this part; there they begin a lodgment for themselves, and for some more, who are sent after them; when there is room to receive them, they make them mount, and insensibly extend the lodgment upon the top of the breach; and thus they proceed till they make a lodgment towards the point, which is generally called a *magpye's nest*. While these sappers are at work, the fire of the batteries and the lodgments ceases; but when the enemy attempt to attack the workmen, in order to destroy their lodgments, they must retire as quick as possible; and then the colours being raised, the batteries fire upon them with the utmost vivacity, to oblige them to quit the upper part of the breach. Upon this the colours are lowered, the fire ceases, and the sappers return to repair the mischief that was done to their lodgment, and try to enlarge and strengthen it. If the enemy should return, they must retire again in the same manner; and the batteries, as likewise the troops in the lodgments, must renew their fire to drive them from the breach; after which the fire once more ceases, and the sappers return to their work.

This way of proceeding must be continued till the lodgment is in a state of defence; that is, till it can hold a number of troops, sufficient to awe the enemy, and to withstand any attack they may happen to make against it. The besieged, before they intirely quit the half-moon, will spring what mines they have ready there. As soon as this is done, the besiegers should directly lodge themselves in the excavations made by those

those mines, or at least some defence should be made there, to hold a few sappers, and to forward the lodgments of the inside of the work.

The lodgment of the point is made in the form of a small arc, the concavity of which is turned towards the place. From each of its extremities a lodgment is carried along the faces of the half-moon, on the platform of its rampart, at the foot of its parapet. This lodgment is sunk deep in the earth of the rampart, to the end that the soldiers may be the better covered against the fire of the place; there must be also traverses to secure it from the enfilades, as was done in regard to the lodgment on the glacis. Within side the half-moon lodgments are also made, which traverse the whole breadth thereof, as may be seen in the half-moon C, Plate XI. Fig. 1. They serve to command the communication between the tenaille and the place, of course to render that communication more difficult, and to hold a sufficient number of troops to resist the enemy, should they have any design to return and repossess themselves of the half-moon.

Though the half-moon should happen not to have a revetement, but only to be fraized and palisaded, still the attack ought to be carried on just in the same manner as if there was a revetement; that is to say, the batteries should be disposed in the manner as above laid down; and in regard to the breach, the business then would be only to destroy the fraize, the palisades, and the hedge of the berm (if there should be one opposite the part where the besiegers want to enter the half-moon) and afterwards to take possession of it, and make lodgments, as in half-moons that have revetements.

What we have been observing, in regard to the attack of the half moon, is only when the besiegers intend to take it by the sap. or with pick-axe and spade; but sometimes they go about it in a more expeditious manner: for when the breach is made, so as the troops may mount to enter the half-moon, they

advance boldly to the assault, just as in the attack of the covert-way sword in hand, and endeavour to come up with the enemy, and to drive them intirely out of the work. This attack is very dangerous, and may cost a great many men, when there happens to be a brave garrison, who will not easily yield their ground. But there are frequent cases, in which it may be thought prudent to adopt this measure, in order to accelerate a few days the taking the half-moon. As soon as the besiegers are masters of the upper part of the breach, they make a lodgment there in a hurry with gabions and fascines; and while it is making, as also while they charge the enemy, and oblige them to abandon the upper part of the breach, some soldiers are sent to discover the mines, which the besieged are supposed to have made within the inside of the rampart of the half-moon, and to cut off the saucisson. If they cannot find them, they must advance with great circumspection, and take care not to keep all together, that the mine may have less effect. Oftentimes the enemy will suffer the besiegers to carry on their lodgment without making any great opposition, because it cannot be effected without a considerable loss of men, the sappers and the troops being absolutely exposed, during this operation, to the whole fire of the place, which is well served, and by its proximity becomes extremely dangerous: but when the lodgment is advanced, the enemy spring their mines, and return afterwards to the half-moon, in order to retake it amidst the confusion, which those subterraneous fires must unavoidably occasion among the troops in the lodgment. In that case, it will be requisite to renew the charge most vigorously with fresh troops, which should be at hand to support those of the half-moon, to place themselves in the excavations made by the mines, to render the lodgment sufficiently strong, and to secure it with a proper number of soldiers, so as to be able to withstand any further attempt of the enemy.

This

This work can hardly be disputed in this manner, except when the half-moon has a reduit, as it affords a shelter or retreat to the garrison, and enables them more easily to fall upon the half-moon. For if there should be no reduit, and the enemy are driven out of the half-moon, they can scarce attempt to return, especially if the communication between the place and the half-moon is discovered by the batteries and lodgments of the covert-way; because if the ditch is filled with water, this communication can hardly be made but with boats, which may be easily seen from the lodgments of the covert-way, and may be overfet by the cannon of the batteries; and if the ditch be dry, and there happens to be a caponnier, the communication, though more safe, is not without danger, by reason of the fire that may plunge into it from the lodgments of the covert-way, so that it will be extremely difficult for the enemy to advance quick enough to repofsess themselves of the half-moon; besides, they want room to assemble in a large body, and fall all at once upon the lodgments of that work.

There is only one case in which they may do it; that is, when in the angle of the gorge of the half-moon they have made a space, nearly as large as the places of arms in the covert-way. This space cannot be seen from the covert-way, nor from its lodgments; and as there are generally steps to ascend from the bottom of the ditch to the half-moon, the enemy might take advantage thereof to try to enter it; but if the besiegers are upon their guard, they will find it easy to repulse them, even with loss, because in that case the enemy have the advantage of situation against them, and are obliged to attack without cover, while the besiegers are sheltered by the lodgment.

The best time for attacking the half-moon sword in hand is by night, for the enemy's fire is not so sure then as by day.

XIX.

Attack of the reduit.

WHEN the several lodgments of the half-moon are effected, the enemy will scarce be able to stay any longer in the reduit, especially as the communication between it and the body of the place must become extremely difficult, and is likely to be more so, if the ditch is filled with water, and the bridge of communication between it and the town is demolished by the batteries on the ridge of the glacis; in this case the troops in the reduit will hardly be able to avoid surrendering themselves prisoners of war, as was the case of those who were in the reduit of the half-moon at the siege of Ath in 1697.

To avoid this inconveniency, the enemy generally think proper to abandon the reduit, as it no longer serves to dispute the lodgments of the half-moon, or to afford a retreat to the troops that defend it, when they find themselves incapable of resisting any longer the attacks of the besiegers against this work.

Reduits, generally speaking, consist of a single wall, with loop-holes: but when they happen to have a rampart and a parapet like the half-moon, after taking the latter, the same method almost must be observed in attacking the former; they may be battered in breach, by placing the cannon on the ridge of the glacis of the salient angle of the covert-way, opposite the half-moon to which the reduit belongs. The descent and passage over the ditch is to be made there, just as in the half-moon; and, in short, a lodgment is effected, either by means of sappers, who are to carry on their work under the protection of the batteries of the covert-way, and its lodgments, or by attacking it sword in hand, as was mentioned in regard to the half-moon.

If

If the enemy have contrived places of arms at the bottom of the dry ditch of the half-moon C, which, as it is well known, do consist only of an elevation of ground that traverses the breadth of the ditch towards the extremity of the faces of the half-moon, in the part opposite to its flanked angle, and which for this reason are sometimes called by no other name than traverses; care must be taken to oblige them to retire from thence, either by the fire of the lodgment on the ridge of the glacis, or by enfilading and firing into them from some lodgments made in the places of arms of the covert-way.



XX.

The attack of the bastions.

WHILST the besiegers endeavour to possess themselves of the half-moon, they work the same time at the descents into the ditch, which are made nearly towards the third part of the faces, reckoning from the flanked angle of the bastion. A descent may be effected at each face of the two bastions in the front of the attack, as in *n, n*, Plate XI. Fig. 1, or according to the more general custom, only opposite the faces in the front attacked. The manner of proceeding is much the same as in the descent and passage over the ditch of the half-moon, whether it be dry or wet; that is, if it be dry, a sap is carried into the ditch, from the opening of the descent to the foot of the breach, and strongly covered towards the opposite flank. If the ditch be full of water, it is passed over on a bridge of fascines, constructed in the same manner as in the passage over the ditch of the half-moon.

The batteries erected on the ridge of the glacis for making a breach in the face of the bastions, must fire against that part of the faces where the breach is to

be effected, and fire all together, as was mentioned in the article of the attack of the half-moon: and when they have made a breach sufficient to attempt the attack in front, some of the guns must be kept to batter the upper part of the breach, and some must be removed to the back of the platform, and disposed in such a manner, as to be able to annoy the enemy, whenever they present themselves towards the upper part of the breach. All this is done during the descent and passage over the ditch. Mines are also made use of to widen, and sometimes even to make the breach.

To fix the miner to the wall when the ditch is dry, a lodgment is made near the opening of the descent, to protect him from thence against the sallies of the besieged. Then the wall is broke with cannon, as near as possible to the bottom of the ditch, in order to get under the galleries, which the besieged may have built within side the bastion. An opening of five or six feet may be made with the cannon, to lodge the miner that removes the rubbish, and makes room for one or two of his comrades, who are to assist him to get rid of the earth in the gallery. When the ditch is dry, and the ground will admit of it, the miner sometimes gets under it by a subterraneous gallery, which leads him to the foot of the wall: but if the ditch be filled with water, it is not always the custom to wait for the completing of the passage over the ditch, before the miner is fixed to the face of the bastion. The wall is pierced with cannon, in the manner before mentioned, but a little above the surface of the water, to the end that the miner may not be incommoded in this gallery; and he is sent over in a little boat, to place himself in the hole. The enemy, on the other hand, spare no pains to destroy the miner in their gallery. When the ditch is dry, they throw a great number of shells, grenades, stones, and all kinds of combustibles before the hole, to hinder any succours from being sent to the miner. M. Vauban, in his *Treatise of Sieges*, proposes the making use of pumps, to extinguish
this

this fire. At present we have far better machines of this sort than were used in his time, for throwing water into whatever part we have a mind; but it does not appear that one can always have water enough in a dry ditch to work the pumps; besides, it is difficult to make use of them, without exposing one's self too much to the enemy. Be that as it may, when the wall has been thoroughly pierced by the cannon, the miner will have very little occasion to be under any apprehension of the fire that shall be thrown before the hole, so that he may proceed in his work with all diligence, and finish his gallery. Besides, the assistance which the cannon gives him at first, in procuring him a kind of cover in the hole made in the rampart, it may likewise shake, and even burst any galleries that the enemy may have near the wall, and thereby enable the miner to proceed with greater safety. The miners relieve one another every two hours, to carry on their work with more speed, that is, to complete and finish their mine. At the same time the enemy will use various artifices to obstruct them.

When the miner has pierced the wall, he makes behind it, on both sides of him, two small galleries, from 12 to 14 feet, at the end of which he places, on both sides the galleries, two mines, namely, one within the breadth of the wall, and the other sunk 15 feet under the rampart. A common train is given to these four chambers, which taking fire at one and the same time, will produce a very large and spacious breach.

When there are countermines under the rampart, and along its revetement, care must be taken to seize them, and to drive the miners from thence. For this purpose M. Goulon proposes to spring two *fougasses* near them, in order to burst them; when this is done, he is for entering it with ten or twelve grenadiers, and as many soldiers, commanded by two serjeants; part of these grenadiers should have each four grenades, and the rest should carry four or five small bombs, of which three only should be charged, the other two with fuses

fusees only. The two serjeants should begin with attacking the countermine sword and pistol in hand, and the grenadiers should follow them. If the besieged do not appear to defend their countermine, a lodgment is quickly made with sand-bags. This lodgment consists of no more than a good traverse, which intirely stops up the gallery of the countermine, towards the side from whence the enemy may come. If they attempt to oppose this operation, the grenadiers should throw their three loaded shells, and retire quickly with their comrades, to prevent being hurt by the effect of those shells; for the smoke they make in bursting, together with the splinters, must unavoidably oblige the enemy to quit the gallery for some time: but as soon as they have produced their effect, the serjeant and the grenadiers, with their comrades, must immediately return, and work as hard as possible upon their traverse, in order to stop up the gallery. If the besieged still persist in interrupting this work, the grenadiers must throw the two shells with fusees only, which will oblige the enemy to retire quickly; and as no harm is to be apprehended from them, which is more than the besieged can tell, the besiegers continue to finish the traverse. Even openings or loop-holes are made, in order to fire upon the enemy, in case they should appear again in the part of the gallery opposite the traverse.

When there is no gallery or countermine behind the walls, or when there is one, which cannot easily be come at, the miner should leave no means untried to discover it; and at the same time he ought to use the utmost precaution to prevent being surprized himself by the enemy's miners, who will attempt to smother him in the gallery, and to destroy his works: therefore the business of a miner requires great art and cunning, to avoid the snares of the enemy. "A miner, says M. de Vauban, in his Memoirs, "ought to listen frequently to discover whether there are any at work under him. He ought to sound with his augre
" towards

“ towards the place he hears the noise come from ;
“ but the enemy often make a noise on one side,
“ while they are at work on the other.” If their miner draws too near, a small mine must be made to stifle him in the gallery ; which may be effected thus : a hole of five or six inches diameter, and six or seven deep, is made on that side the gallery where the enemy is heard ; a cartridge of the same size, and containing about ten or twelve pounds of powder, is put into it : the hole or opening towards the gallery is stopped close with a strong tampion, which is immediately applied to the cartridge, and supported by strong planks well buttressed : this powder is set on fire by a fusee, which passes through a hole made in the tampion, and communicates with the powder in the cartridge. If the gallery of the enemy’s miner is within four or five feet of this powder, it will undoubtedly burst, and the miner will be either killed, or obliged by the smoke to retire. The enemy’s miner may be likewise driven away, and his gallery destroyed, by blowing up successively, as we before observed, several small *fourneaus* or chambers, which will unavoidably give a shock to the earth ; and not only that, but burst and crack it, and fill it with such a stinking smell, that nobody will be able to support it, which must absolutely render it impossible for the enemy’s miner to work there any longer. There is less inconveniency on the part of the besiegers, because the galleries being much smaller, and not so deep as those of the besieged, the air circulates with greater freedom, and will be the better able to dispel the stink.

Another way of bursting the gallery of the besieged, when it is at no great distance, is to put several shells on the side where the enemy’s miner is at work, and to range them in such a manner that they shall have their effect. When the miners are at work in search of one another, they have great iron borers, with which they pierce the interval betwixt them, to find, as near as they can, their distance from one another.

another. The miner must be very vigilant, and as soon as the borer is withdrawn he should clap a pistol into the hole, which, when well directed, and fired by a man of resolution, seldom fails, as M. Vauban affirms, to kill the miner. The first shot ought to be followed by three or four more; then the hole should be cleaned with the borer, to prevent the enemy from stopping it up on their side: and this is a matter of importance; for it will hinder their miner from continuing his work in that spot, and oblige him entirely to abandon it. These and many other stratagems, which may be seen in the Memoirs of M. Vauban, plainly shew that the business of a miner requires not only address and cunning, but likewise great courage and resolution, to guard against, and to remove the several obstacles that may be thrown in his way, with a view to prevent the progress of the works committed to his direction: he may easily guard against them, when he is undermost; but if it be otherwise, his situation is extremely bad. In order to know for certainty whether they are at work under the gallery, the miner generally makes use of a drum with something upon it, and then the shaking of the earth must occasion a kind of trembling, which will discover that they are at work underneath. Sometimes he listens with his ear to the ground; but the fluttering of the drum is the surest way. This is one of the chief advantages of the besieged, that they always have it in their power to work undermost on their own ground. By that means they may stop the miners of the besiegers at every step, and make them pay very dear for the ground which at length they are obliged to yield; I say to yield, because, as the besiegers are far more numerous than the besieged, have more powder, and greater resources to repair their losses, whether in men or in ammunition, they must at length compel the besieged, who have not the same advantages, to surrender, through inability of renewing their efforts in the same manner.

While

While the miner is working upon the construction of his gallery, the besiegers must be employed in demolishing all the works of the enemy, and disabling them from defending or repairing the breach. With this view a continual fire is made against the breaches, which will hinder the besieged from shewing themselves in that part, and from advancing to see the works, which may be made in the ditch, or at the foot of the breaches. If there is a *tenaille* before the curtain, batteries are placed in the re-entering places of arms of the covert-way of the half-moon, which plunge into the *tenaille*, and hinder the enemy from making use of it to disturb the passage over the ditch. And in order to silence them further, another battery of mortars may be erected, in the most advanced lodgment of the gorge of the half-moon; which battery being well served, will render it too dangerous and inconvenient for the besieged to abide there, so as to have the attention requisite for obstructing the passage over the ditch.

But sometimes the enemy will make oblique embrasures in the curtain; and from thence they fire on the lodgments of the covert-way, so as greatly to incommode both those lodgments, and the opening of the descent into the ditch. The Imperialists, at the last siege of Philipsburg, had made such embrasures in the two curtains of the attack, which would have destroyed a great many men, had the besiegers been obliged to erect batteries on their counterscarp, and to make the passage over the town ditch. The way to prevent the effect of those batteries, is to endeavour to destroy them with shells; and, when the ground will permit, to enfilade the curtain with *ricochet* firing. Four or five pieces may be also placed on the upper part of the flanked angle of the half-moon; in which position they can fire directly upon the curtain, and plunge into the *tenaille* and the postern by which the enemy keep a communication with the ditch, when it is dry. In short, all methods are tried that

that experience and genius can contrive, to gain a superiority over the enemy's fire, so as entirely to silence it, or at least to hinder them from shewing themselves at any of their defences, without being exposed to the fire of the batteries and lodgments.

Hitherto we have taken no notice of the concave flanks and orillons. The advantage of these consists chiefly in securing the cannon near the reverse of the orillon, which, as it is not seen from the opposite covert-way, cannot be dismounted by the batteries that are placed there. Could this cannon be secured from bombs, it would undoubtedly be of very great advantage to the besieged: but this cannot possibly be presumed; therefore it is of less service now, than when M. de Vauban used it; for at that time there was not so great a consumption of bombs in sieges, as at present. The concave flank or orillon would make no change at all now in the attack; the besiegers would have only to throw a number of shells into the orillon, and the part of the flank immediately joining to it, and these shells would undoubtedly destroy the embrasure concealed and protected by the orillon. It must, however, be allowed, that the concave flanks have still one advantage, that they cannot be enfiladed by the *ricochet* batteries. The strait flanks indeed may be enfiladed from the batteries placed in the re-entering places of arms of the covert-way, opposite the faces of the bastions; but the concave flanks, by means of their disposition, are sheltered from those batteries.

Let us at present suppose that the passages over the ditches are finished, so as to be fit to walk over; that the cannon or the mines have made the breacher sufficiently wide for the assault; that the ascent is made smooth, and that the besiegers can easily mount to the top of the breach; then they may lodge themselves there, by following either of the two methods mentioned in the article of the half-moon.

Namely,

Namely, by sending a few sappers, who, under the protection of the fire of the batteries and the lodgments of the covert-way, shall begin to lodge themselves there, or by ordering a body of troops to take possession of it sword in hand; or, which is the same thing, by attacking the bastion.

If the enemy have made no retrenchments in the inside of the bastion, they will hardly venture to stand an assault, as this would only expose the place to be carried sword in hand, themselves to be taken prisoners of war, and the town to be plundered. Therefore every thing being ready for the assault, they will *beat the chamade*, that is, they will desire to surrender on certain terms: but if the besiegers presume that they shall be able to make themselves masters of the place without any great loss by an assault, they will grant none but very hard conditions. The more the besieged are able to defend themselves, the better conditions they will obtain, though less honourable. The duty of the officers of a garrison is to make as long a defence as possible, and not to think of surrendering, till it is evident that there is an impossibility of holding out much longer, without exposing both the place and the garrison to the discretion of the besiegers. A vigorous defence conciliates respect from a generous enemy, and oftentimes engages him to grant the honours of war to the governor, in consequence of his bravery and abilities. Here we suppose that there have been good retrenchments made long before the siege, or at least at the beginning of it, which shall enable the garrison to stand an assault of the body of the place, and to capitulate behind their retrenchments. In that case the besiegers must determine to storm the breach, and to make a lodgment on the upper part of it, after driving away the enemy.

When a resolution is taken to attack the bastions while the mines are making and charging, a considerable heap of materials is laid up in the lodgments nearest

nearest the breaches, that they may be handed readily for the construction of the lodgment, as soon as the enemy is driven away. Every thing being prepared to set fire to the mines, all the grenadiers of the army are ordered to march to the assault; and they are to be supported by a sufficient number of detachments, that the enemy may not be able to make a stand. These troops being ready, the mines are sprung; and as soon as the dust is a little laid, the grenadiers commanded to march and to mount foremost, move on to the foot of the breach; and when they get there, they mount immediately with their bayonets fixed, and are followed by the rest of the troops that are to support them. The enemy will not fail to make use of their mines, if they have any left; and will likewise throw all kinds of combustibles, to make the besiegers pay as dear as possible for the ground, which the besieged will be obliged to yield in the upper part of the breach; for yield at length they must, and the superior numbers of the besiegers must surmount every obstacle. If the latter are so fortunate as to repel the first attack, they will not be able to do the same by a second, or a third; in short, they must at length determine to retire behind their retrenchments. As soon as they are beaten away, and have abandoned the upper part of the breach, the besiegers must set about making a lodgment; which will consist at first of a kind of arc of a circle, the convexity whereof is turned towards the enemy, if there is a breach in the faces of the two bastions, otherwise it will only be made on the upper part of the breach. The breaches are to be all stormed at the same time, by which means the resistance of the enemy will be divided. This whole time the batteries and lodgments are to fire with all the vivacity possible against the several defences of the enemy, and against every place they are in and that can be fired against, without annoying the troops that are storming the breaches.

The lodgment on the breach being made, the saps are carried on to the right and left towards the center of the bastion, and disposed in the manner as in Plate XIV. Bastion A. Cannon are brought upon the breach to batter the inner retrenchment, the ditch is passed over here also, and a lodgment is made upon the breach, in the manner as hath been mentioned in regard to the bastions.

If behind this first retrenchment there was a second, the enemy, after being forced to quit the former, retire to the latter to capitulate. The consequence then would be, to attack them as in the former; and at length they must be forced to surrender. It is very rare to see a defence carried so far as we have here supposed; but it was incumbent upon us to make this supposition, in order to give an idea of what was proper to be done, should the enemy resolve to defend the place to the last extremity.

In attacking the inner retrenchments, besides cannon there must be bombs and stone mortars. The bombs do a great deal of mischief, because the enemy are obliged to keep close together in those retrenchments, which are always very small; and for this reason the stone mortars are of excellent use, because of the shower of stones which they throw into those works, and which kill and wound a multitude of men.



XXI.

Recapitulation of the attack of a place.

THE detail we have been giving, includes what is most general and essential to observe in the attack of a regular fortification; and from thence rules and maxims may be derived for all other attacks, whether of regular or irregular works, or whether there are more outworks than we have here supposed.

First of all the approaches are to be carried on the nearest way possible without being discovered, and without running the risk of seeing the trenches attacked and destroyed by the enemy; the next thing to be observed, is not to proceed without being supported by parallels, which should contain a number of troops sufficient to make head against the garrison. It is requisite also for the preservation of the troops to carry on the works by saps, as soon as the fire of the place grows too dangerous to proceed uncovered.

It is evident, that if the enemy could remain unmolested in their defences, they would be able to make a brisk and continual fire against the trenches, and of course to render the approaches far more tedious and difficult. Hence it is of the utmost consequence to drive them from thence; which is done by means of the ricochet batteries. When the situation of the place will permit the placing of these batteries on the produced faces of the works attacked, the enemy cannot appear on the ramparts and the works that defend them, without being exposed to the fire of these batteries; consequently they will be more confined in their defence, and unable to fire so briskly as they would otherwise do. The shells thrown against them on all sides, in order to dismount their batteries, cannot miss at length of obtaining their end, or at least of disturbing them greatly.

By the disposition and construction of the places of arms or parallels, the enemy are shut up in the place, and disabled from making sallies, without exposing themselves to evident danger. They see themselves streightened daily, without being hardly able to raise any obstruction.

The saps advancing continually, at length will reach the glacis; and provided the besiegers have but patience to carry them on to the covert-way, they will drive them from thence also, and without great loss. All that is wanting for that purpose is but a little patience,

tience, and to take care that the saps be well supported, so that the enemy shall not be able to do any great mischief whenever they fall upon the workmen.

As soon as the besiegers are masters of the covert-way they must make a strong lodgment on the upper part of its glacis, and erect batteries there, in order to demolish the works proposed to be attacked, as well as their defences; and in the mean time, they must prepare for the descent and passage over the ditch. As soon as this passage is effected, and the breaches are made, and the miner is fixed to the wall, either to widen the breach, or to discover the enemy's chambers, the work must be taken by sap, or sword in hand; then good lodgments must be made, and the attack of the other works carried on, by repeating the same operations.



XXII.

Attack of a place covered with fore-ditches, lunettes, and other outworks, &c.

IN order to give a more simple idea of the operations of a siege, we have explained and applied them to a place, that had no other outworks than half-moons and a covert-way: but a greater number of works will make no alteration in the principles here established: to take, and keep possession of those works, the besiegers have only to follow the same rules; which we shall shew in a few words.

Let us suppose a place surrounded by a fore-ditch, and a second covert-way, strengthened with lunettes, and suppose the front by which it may be attacked, is covered with a horn, or crown-work, &c.

First of all the trenches are to be opened as usual, in order to come to the foot of the glacis of the second

covert-way; the ricochet batteries are to be placed on the produced faces of the works attacked, and of their defences; the faces of the lunettes of the front attacked ought to be enfiladed by the ricochet batteries.

The second covert-way is taken in the same manner as the common covert-way; and then if the fore-ditch is full of water, a good lodgment is to be secured along this ditch, and batteries are to be erected to make a breach in the lunettes, if the enemy do not think proper to quit them. It is very difficult for them to maintain themselves in those works, when their communication is seen; and they can hardly avoid being seen, when a lodgment is made all along the fore-ditch. Be that as it may, supposing that they are lined with stone work, or only with turf, that they are fraized and palisaded, and that the enemy are obstinate in their defence, a breach may be made in them, by placing some cannon opposite the middle of the faces, and the ditch may be passed over by filling it with fascines, or some other materials. As it is a great deal smaller than that before the body of the place, it is much easier to pass.

When the besiegers have made themselves masters of the lunettes which cover the front attacked, they begin to think of passing the fore-ditch. This is a very difficult task, because it is performed under the grazing fire of the covert-way; but this fire ought to be checked by the ricochet batteries, which should plunge into the covert-way on every side. This ditch is crossed near the saliant angles of the glacis. It is always to be understood, however, that there is no possibility of crossing any ditch without a good epaulement of fascines, to cover the passage on the side which is seen by the place, or by the works that defend it.

When the lodgment is entirely finished on the covert-way, then the other attacks are carried on in the manner as before explained.

There are places which, without any fore-ditch, have lunettes opposite to the saliant and re-entering angles

angles of the glacis, which are also enveloped by a second covert-way: sometimes they are vaulted and bomb-proof, as at Luxemburg; and sometimes they have only a ditch, a parapet, and a covert-way.

Those which are vaulted and bomb-proof, are very difficult to take; because the ricochet-firing and the bombs can do them no mischief. In that case they must either be *turned*, or be taken by mines.

A work is said to be *turned*, when the besiegers get between that work and the place, and so cut off their communication. Sometimes the lunettes have communications under ground, and then there is hardly any other way of driving out the enemy but by mines.

This is tedious work, but there is no remedy for it.

The lunettes and the ditch are always defended by branches of the covert-way, with which they have also a communication, like those of the lunettes, A, A, Plate XV.

This plate, which represents part of Landau and its attacks in 1713, may serve to give an idea of the manner in which a work is turned. The advanced lunette B, as well as the work C, called a *tenaille*, are turned; that is, the trenches cut off the communication betwixt them and the place.

When this communication cannot be cut off, there will be often a necessity for attacking the lunette and the covert-way at the same time; and the reason is, because though the enemy should be obliged to abandon the lunette, yet so long as they are masters of the covert-way, they have it in their power to return and retake it. Therefore the sure way of keeping possession of it, is to drive the besieged out of the covert-way, at the same time that they are forced to quit the lunette.

The garrison may avail themselves greatly of mines, for the defence of these small outworks, so as to oblige the besiegers to pay very dear for their acquisition, and be a long while in making it. But they must pursue

the same methods as the besieged; they must dig deep into the earth, they must endeavour to destroy the enemy's miners, to blow up their galleries, and to make themselves masters of the lower ground. This is an essential point, without which the enemy may blow up and destroy the lodgments several times. The celebrated M. de Valiere, in a Dissertation on Mines, at the end of the third volume of M. Folard's Commentary on Polybius, shews that in a ground 25 or 30 feet deep, the enemy may be blown up twenty times. Therefore it is impossible to be too cautious in endeavouring to get under the gallery of the besieged, in order to prevent the mischief they may do by their great number of mines.

In the neighbourhood of some places there are a sort of small half-moons, called *redoubts*. When they are distant from the place, the enemy cannot maintain themselves there without exposing their troops to be taken prisoners of war; but when they are covered and defended as they ought to be, and judiciously situated, they are an object worth attention. Endeavours ought to be used to cut off the communication between them and the place, and to oblige the enemy to abandon them by throwing in shells; it may even be proper to insult them and drive them out sword in hand, provided they are not so near the place as to receive powerful succours, and able to withstand the attack. It is a matter of consequence to get rid of these small outworks as soon as possible, because they may be of great hindrance to the progress of the attacks, by having a view of the trenches from the flanks, and enfilading them, &c.

In some sieges, when the garrison are obstinate in their defence, small outworks are made at the foot of the salient and re-entering angles of the glacis; these consist only of a parapet raised at the foot of the glacis upon these angles, each side of which has about ten or twelve fathoms. These small works are called *arrows*. They may be seen in A, A, A, Plate XVI. Fig. 1. They communicate with the covert-way by a passage pierced

pierced on the ridge of the glacis, and palisaded on both sides. At the entrance of this passage is constructed a traverse B, generally called the *tambour*, which hinders the besiegers from being masters of the arrow, or discovering the inside of the place of arms belonging to the covert-way.

To prevent the effect of these arrows, the best method is to ply them well with ricochet batteries, and with shells thrown in also *à ricochet*. Stone mortars may be likewise made use of, to annoy the enemy in their arrows; for as these works are but small, the stone mortars produce a very good effect. We have already taken notice of almost all the works the besiegers may meet with beyond the covert-way; there remains, therefore, only to see the manner of conducting the attacks of the other outworks most commonly used in fortified towns.



XXIII.

Attack of a horn-work.

A Horn-work is nothing more than the front of a fortification, which projects into the field, and is joined to the place by two long sides. It is placed opposite to the curtains, and sometimes also to the bastions. The besiegers should endeavour, as much as possible, to avoid attacking the side covered by these works, because they are very difficult to take, and of course will greatly lengthen out the siege; but supposing there is an absolute necessity for attacking a place on the side covered by a horn-work opposite the bastion, and that this horn-work has an half-moon opposite to its curtain:

The trenches and parallels are to be made in the usual manner; the same method is to be used in regard to the ricochet batteries, which will also enfilade the branches of the horn-work. The taking of the covert-

way of the half-moon, and of the half bastions of the horn-work, is carried on in the same manner as the attack of the half-moon, and the two bastions of the body of the place. There remains, therefore, only to shew how the lodgments are to be made in this work. We will suppose that there are two retrenchments within, as in Plate XIV.

When the lodgments towards the point of the half bastions are finished, some guns are to be planted there, in order to batter the face of the opposite bastion; and they are to be placed overagainst the lodgments of the flanked angles of the half-bastions. These lodgments are to be extended on both sides towards the curtain, along which saps are carried on, as also towards the orillon of the half-bastions, if they are made with orillons; this will form a kind of small parallel, the fire of which will help to cover the lodgments in front, in case the enemy should make any sallies to destroy them. In large fortifications, such as horn and crown works, the lodgments ought to be carried on with the greatest circumspection, in order to be able to support them against every attack of the enemy.

As all these lodgments are commanded by the bastion, it will be requisite to dig the saps sufficiently deep, so as to be secure against their fire; and likewise to make traverses near enough to each other for the same effect.

If the bastion can be battered in breach from the rampart of the half-bastions of the horn-work, the besiegers will for this purpose make use of batteries erected on these half-bastions, and for the same end they will also plant a battery of six or eight guns towards the middle of the curtain. Should it be impossible to sink sufficiently into these, so as to batter the lower part of the revetement of the bastion, still they might be usefully employed in playing against the enemy's defences, and driving them out of their retrenchments. When the lodgments are well secured within, it will be extremely difficult for the enemy (Plate XIV.)

to continue in the retrenchments, without running the risk of being made prisoners of war; because the communication between them and the place will become too difficult. They might indeed, by means of a bridge level with the water, retire into the collateral half-moons: but at the same time that the besiegers endeavour to make themselves masters of the horn-work, they will also strive to get possession of these half-moons, the taking of which must inevitably follow that of this work.

As soon as the enemy are intirely driven out of the horn-work, the besiegers must possess themselves of it by carrying on lodgments which shall occupy its whole extent; and if there be any occasion to erect batteries within, in order to batter the bastion in breach, they are to be erected along its counterscarp, as may be seen in z, Plate XIV. This plate will supply the room of a longer discourse upon this subject.

Sometimes it shall happen, that the ground of the inside of the horn-work will not permit lodgments to be extended there, as they are ranged in Plate XIV, because it may be too wet and marshy, or else of too narrow a circumference; in that case there is no carrying on the lodgments but along the parapet of the front of this work *, and along its branches, if the breadth of the platform of the rampart of these branches will permit. It must be made to defile by frequent zig-zags, or turnings; but if it be too narrow, the only way for the besiegers is to sink very deep, in order to defile from the fire of the place, and to cover themselves by traverses made very near one another.

As the attack of a horn-work before a curtain, differs hardly at all from that of a horn-work before a bastion, and the lodgments are conducted in the very same manner, I shall be excused from entering into any detail in regard to this attack. The foregoing rules may be applied here also.

* See Plate XVII.

Explanation of Plate XIV.

- a* Cavaliers of the trenches.
- b* Batteries of stone mortars.
- c* Batteries to breach the half-moon before the horn-work.
- d* Batteries against the defences of this half-moon.
- e* Passages over the ditch before this half-moon.
- f* Lodgments in it.
- g* Batteries against the flanks of the horn-work.
- h* Batteries to breach the half-bastions of the horn-work.
- i* Batteries against its curtain.
- l* Lodgments in the half-bastions and in the horn-work.
- m* Passages over the ditch before the retrenchments in the horn-work.
- n* Lodgments in these retrenchments.
- o* Batteries against the defences of the collateral half-moons.
- p* Batteries to breach these half-moons.
- q* Passages over the ditch before these works.
- r* Lodgments in the same.
- s* Batteries to breach the reduits of the half-moons.
- t* Passages over the ditch before the reduits.
- u* Lodgments in the reduits.
- x* Bridge of fascines, or a road to carry the cannon to the horn-work.
- y* Batteries against the defences of the bastion A.
- z* Batteries to breach this bastion.
- B* Passages over its ditch.
- C* Lodgments in the bastion A.
- D* Lodgments on the border of the ditch before the retrenchment of the bastion A.
- E* Passages over the ditch before this retrenchment.

The 17th plate represents the plan of the lodgments made in the horn and crown-work of Philipsburg in 1734.

XXIV.

Attack of a crown-work.

THIS attack does not differ from that of a horn-work. The crown-work is entered by its bastion, or by the two half-bastions of one of its fronts; and the lodgments are disposed in the same manner as in the horn-work*: so that to say any thing about the former, would be only a repetition of what has been said already in regard to the latter.



XXV.

Attack of grand lunettes or tenaillons, counter-guards, &c.

ALL these works are attacked by following still the same rules and principles as those above explained. There is no possibility of making lodgments in them, but by destroying some part of the works that defend them; therefore the batteries ought to be disposed in such a manner as to be able to ruin those defences.

In order to attack an half-moon covered with grand lunettes, or, as they are now called, with tenaillons, the two parts of which they are composed must be attacked at the same time, and solid lodgments made therein; the whole covert-way of the front of the attack must be also taken, and then it will be very difficult for the half-moon to stand out any longer. The breach is made by the batteries placed along the great sides of these works, opposite the faces of the half-moon.

As for the counter-guard, it ought to be attacked at the same time as the two collateral half-moons, on which it depends for its defence; the narrowness of its

* See Plate XVII.

rampart renders the lodgment in it extremely difficult and precarious, and therefore it is to be made much deeper. This work will hinder the flanks of the bastions, in the front attacked, from being seen from the covert-way, and the bastions themselves from being battered in breach; therefore as many batteries must be placed in it as would be placed in the covert-way to make a breach, and to ruin the flanks of the bastions, if these works did not cover them.

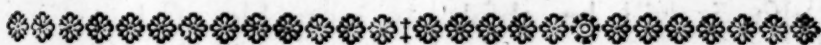
A detail of the attack of the other out-works would be superfluous. Whosoever thoroughly comprehends what has been laid down concerning the attack of the body of the place, will not be at a loss in regard to the attack of the different outworks. It is the same in respect to the attacking of the works of a fortified place, as to their figure; the former may vary without any inconveniency, when they are well defended, and mutually supported, which ought to be the principal view in constructing them: in like manner the figure of the lodgments may vary according to that of the works; but care should be taken never to carry them on farther than they are supported and covered by each other, and by the fire of the batteries which were intended to ruin the defences, or those parts of the rampart, from whence the besiegers may be annoyed by the enemy.

Hitherto we have taken no notice of the attack of citadels, because it does not differ in any respect from that of towns.

If it is not possible to begin with the attack of the citadel, the besiegers must determine to make two sieges instead of one; that is, after they have taken the town, they must lay siege to the citadel. The same may be said touching forts and castles, which serve as citadels to towns, there being nothing particular in the manner of attacking them.

In the several attacks here treated of, we have all along supposed such places and outworks, as are fortified according

according to the present manner: but there are a great many towns fortified after the ancient manner, that is, whose inclosure consists only of a single terrass wall, or one that has a sort of rampart behind it. This inclosure, which of itself would be a very bad defence, is covered with half-moons, counter-guards, horn-works, &c. And these works being judiciously placed, are a defence to each other, and oftentimes make the town as strong as if it was more regularly fortified. In attacking this sort of fortifications, the same method is to be observed, in respect to the trenches and parallels, as was mentioned above; and the works, that cover the body of the place, are also to be attacked in the same manner. The taking of them will bring on the surrender of the place. All that the besieged can do, is to make use of the town-wall as a good retrenchment, behind which they may capitulate. Thus you see that these places are taken according to the same rules, as if they were more regular; which will be an excuse for our not entering into a further detail about them.



XXVI.

The attack of a place fortified with a fausse-braye.

AMONG fortified towns, some may be surrounded with a fausse-braye; we shall therefore mention a word or two concerning this particular attack.

A fausse-braye by its situation being nearly on a level with the covert-way, may greatly encrease the difficulty of making a lodgment in it; but nothing is more easy than to drive an enemy from thence, and from the faces that are enfiladed by the covert-way, as well as from the flanks that may likewise be enfiladed by the batteries placed on the ridge of the glacis. With regard to the curtain, shells are thrown into it if
the

the rampart of the place has no revetement ; and if it has, a constant firing will make such havock with it, that the shivers and rubbish will be able to drive away the soldiers whom the enemy have posted in the fausse-braye. Stone mortars may be also used, to compel the besieged to abandon this out-work ; for as it is very narrow within, there is almost an impossibility of guarding against the effect of the stones. However, before the passage over the ditch is attempted, the enemy must be absolutely driven from hence ; otherwise this passage would be extremely difficult, and attended with great effusion of blood.

As the fausse-braye can make no great addition to the difficulties of the passage over the ditch, when proper precautions have been taken to hinder the enemy from staying there ; neither can it greatly retard the taking of the bastions ; for the rubbish of the breach made in the revetement of the place, will fill up the greatest part of it, so that they will not have room enough any longer to stay there and entrench themselves. Besides, as by demolishing the revetement of the rampart, that of the fausse-braye and its parapet must be demolished also, it will be absolutely incapable of being supported, and of course the enemy will be obliged to abandon it.

In order to storm the bastion, the breach of the fausse-braye, as well as of the revetement of the rampart, must be made practicable, by disposing them in such a manner that their rubbish shall make but one inclined plane, which will produce a much easier and gentler slope than if there was no fausse-braye. In the parts of this work immediately bordering on the breach, small lodgments may be made, proper for supporting that of the upper part of the breach of the bastion, and for heaping up materials to perfect and enlarge it.

REMARK.

REMARK.

From what we have been saying, in regard to the *fausse-braye*, it follows that it is a work of very little defence; for which reason it has been laid aside a great while. For among the vast number of fortifications, that were erected during the long reign of Lewis XIV, there is hardly any, but the citadel of Tournay, that was fortified with *fausse-brayes*. "Besides, says an able engineer*, we cannot tell what induced M. de Me-grigny, who fortified this citadel, to make *fausse-brayes* round it; since all French engineers, in consequence of the experience acquired in several sieges, have condemned them as very defective."



XXVII.

Of the attacks of cavaliers.

CAVALIERS are elevations of earth, on the platform of a full bastion, of the same form, and whose flanks are four fathoms distant from those of the bastion, and the faces three only.

The advantage the enemy may receive from cavaliers, consists chiefly,

1. In preventing different parts of the town, and of the fortification, from being enfiladed.
2. In obliging the besiegers to open the trenches at a greater distance, for fear of being exposed to the fire of the cavalier, which reaches further than that of the bastion.
3. In discovering the inside of the trenches, in enfilading and plunging into them.
4. In doubling the fire of the bastions, on which the cavaliers are built.

* M. Rozard.

As the elevation of the cavaliers renders them proper, on the one hand, for discovering the country, and for annoying the besiegers in the erecting of their batteries; on the other hand, it exposes them to be battered with ease, when once they are erected.

To oblige the enemy to abandon the cavaliers, or at least to diminish their fire, a great number of shells must be continually thrown into them; which will make great havock, dismount their batteries, break their carriages, and even hinder the enemy from replacing them, at least not without considerable loss, if the besiegers continue to play upon the cavalier.

It is proper also to fire very briskly upon the revetements of this work, to the end that the part of the rampart, which is at the foot of the cavalier, may be filled up with its rubbish, so that there shall be no more room left for the enemy to retrench themselves there, in order to stand the assault of the bastion.

When the miners are got under the bastion, they must carry their galleries under the cavaliers also, in order to breach them both at the same time, and to fill up the ditch with their rubbish. When this is done, the breach must be rendered practicable, and of easy ascent; after which it may be presumed that the enemy, having it no longer in their power to make retrenchments, either in the bastion or in the cavalier, which are supposed to be intirely demolished by the shells, will think proper to surrender, for fear of being overpowered in the attack. Yet if the bastion must absolutely be carried by assault, the same rules are to be followed as in taking the bastions of the front attacked; and when the besiegers have mounted the rampart, they must make small lodgments on both sides of the breach, at the foot of the cavalier, to support the lodgment in the upper part of the breach, the whole as has been observed in the article of *fausse-brayes*.

REMARK.

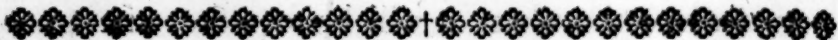
REMARK.

The construction of cavaliers in the bastion, after the manner of those above mentioned, hinders the besieged from making retrenchments there; though several authors have condemned this position, and proposed placing them in the curtain. But such a position would greatly embarrass the rampart; therefore their most natural and most convenient situation, seems to be near the center of the bastion, in such a manner, that most of the space between the faces of the bastion shall be left open; and instead of making the cavaliers of the same figure as the bastion, they may be constructed, as has been practised in some places, in the form of a semi-circle somewhat flattened. In this position they do not hinder the defence of the bastion; but then they will be a weaker support to the ditch, and to the other parts of the fortification. However, as very little stress is laid on the defence they are capable of making, when very near, and by plunging into the works; it seems that this inconvenience can no way balance the advantages arising from the space left on the rampart, between the cavalier and the faces of the bastion.

For when the besiegers have made a breach in the bastion, there still remains, on both sides of the breach, room enough to erect good traverses on the rampart, behind which the garrison may with advantage dispute the lodgment on the breach, and retard the taking of the bastion.

However, upon meeting with cavaliers of this sort, the besiegers should not only throw a great number of shells into them, as into the former, but moreover throw them plentifully against the foot of the cavalier, to hinder the construction of the traverses, and the other retrenchments, which the enemy might make at the foot of the cavalier. When every thing is ready for giving the assault, it will be requisite to throw a shower of stones upon the bastion, in order

to chase the enemy from those retrenchments, or to tumble them headlong into the ditch by springing of mines.



XXVIII.

Attack of a place fortified with tower-bastions.

A PLACE fortified with tower-bastions offers nothing particular, after what has been said in regard to the other attacks. The counter-guards of this sort of places, being nothing more than detached bastions, ought to be attacked pursuant to the same rules as the other bastions. But as they are not joined to the place, and as the enemy may defend them to the last extremity, without exposing the town to the danger of being taken by storm, they must be attacked with great caution, their defences must be demolished, and the batteries must be kept continually playing, to disable the besieged from maintaining themselves in those works.

As the communication between the counter-guards and the tower-bastions, is effected only by small bridges level with the water, and placed along the flanks of the tower; and moreover as those bridges are very narrow, the garrison cannot have an easy retreat: therefore if the besiegers, after securing a good lodgment on the upper part of the breach of the counter-guard, should make a vigorous attack upon those who defend it, they may be either tumbled into the ditch before the tower, or taken prisoners of war.

When the enemy are driven out of the counter-guard, the besiegers will find themselves exposed to the fire of the tower-bastion, which will make them lose a great many men, while the lodgment is effecting. But in order to abate that fire as much as possible, batteries must incessantly play upon the tower, and upon every part of the fortifications, by which the counter-

counter-guard is defended. The lodgment is extended along the faces and flanks of the counter-guard, and traverses are made near one another, in order to defile from the tower-bastion.

To reduce the tower it will be requisite, after putting the lodgments of the counter-guard in a good condition, to erect a battery on the upper part of the rampart of the counter-guard opposite to its flanked angle, and to that of the tower. But if the point of the counter-guard should happen to be entirely ruined, or if the earth of the rampart could, without very great trouble, be detached from its point, so that the batteries placed in the covert-way, opposite the flanked angle of the counter-guard, could discover the tower, and batter it in breach, the besiegers might spare themselves the trouble of erecting batteries in the counter-guard, and should endeavour to destroy the tower with the batteries of the covert-way. As the flanks of the tower-bastions are not seen from the covert-way, and as they are hid from thence by the extremity of the flanks of the counter-guard opposite the shoulder, this part must be destroyed by the batteries which were made use of to demolish these very flanks; and afterwards with these same batteries must the flanks of the tower-bastions be battered and destroyed. While the cannon are playing upon the flanks and faces of the tower-bastions, the besiegers must also make a continual fire of grenades and musketry to keep off the enemy. They ought to throw a great number of shells into it before they take possession of the counter-guard, in order to pierce the vaults, and render its reduction more easy.

As soon as the flanks of the tower-bastions and their faces are demolished, preparations must be made to pass their ditch. For this purpose it will be necessary to carry the lodgment of the counterscarp along the counterscarp of the tower-ditch; and to erect batteries, if wanting, in order to ruin that part of the curtain from whence this ditch draws its defence, as well as the

flanks of the curtain, if it has any, which is the case of New Brisac. This ditch may be filled by blowing up a few small mines on the border of the counterscarp, ranged in such a manner that the rubbish will help to fill it.

When the passage is ready, it is made on both sides of the tower, that is, on each of its faces; the besiegers must endeavour to lodge themselves on the point of the tower, and then make the miner get within side of it, in order to work a mine that shall open the tower, and afford an opportunity of penetrating into the place.

This whole operation may meet with great difficulties, when the besiegers have to deal with a brave and skilful enemy; but diligence, numbers, and valour must prevail at last. M. de Folard calls the tower-bastions by the name of *cut-throats*; and indeed if they were well disputed, the taking of them would cost the besiegers very dear. Landau, which has four tower-bastions, was taken four times in the war of 1701 without attacking those towers; the place having always capitulated after taking the counter-guards in the front attacked.

If the besiegers are afraid they shall meet with too many obstacles, in endeavouring to penetrate into the town by the tower-bastions, they may try to enter by the curtain; and therefore they are to erect batteries in the re-entering places of arms of the covert-way in the front attacked, in order to batter the curtain in breach; and after making themselves masters of the two counter-guards of this front, they may very easily make a bridge over the ditch, to pass from the half-moon, or its reduit, to the tenaille between the two counter-guards. The lodgment which ought to be made in these two outworks will facilitate the ruining the faces of the towers; and the ruining of these faces will afford means of discovering the flanks, and of driving the enemy from thence by a continual fire of musketry and large grenades. But it would be dangerous

dangerous to throw in shells, because of the little distance from the towers to the lodgments of the counter-guards. When once the enemy are driven from the upper flanks of the towers, they have nothing left but the casemates or vaults within side, to dispute the passage over the ditch before the curtain; but the rubbish of the breach of this curtain will stop their progress; therefore there is no great danger in attempting the passage over the ditch between the tenaille and the curtain. If the curtain has flanks, the enemy will be driven from thence by continually firing at them from the lodgments of the counter-guards, and the passage over this ditch may be easily effected. As it is not very wide, the besiegers will fill up a part sufficient to attack the breach with a strong body. When they are ready to march and to give the assault, the enemy will not fail to beat the chamade, because if they were forced, there would be no retrenchments left behind to make a capitulation, and of course they would be obliged to surrender at discretion.

We must observe, that if the counter-guards were built with a half revetement, such as those of New Brisac, they should be attacked in the same manner as if they had an entire wall. The besiegers are only to mind to beat down with their cannon the palisade or the hedge planted on the border of the berm, and then make a breach in the usual manner. The half revetement may even facilitate the means of a lodgment there; because as it forms on the border of the ditch a space not unlike that of a *fausse-braye*, it may serve for establishing small lodgments, proper to support and protect that on the upper part of the breach.

R E M A R K.

It may not, perhaps, be amiss to observe, that the attack of tower-bastions, in M. Vauban's Memoirs, seems to be an article which the editor has taken the liberty to add to the work. That several reflections and observations, never made by this great man, were in-

serted in these Memoirs, is a thing beyond all doubt; for here mention is made of the siege of Lisle under Prince Eugene in 1708, and yet M. Vauban died in 1707.

What gives us reason to suspect that the article of the attack of tower-bastions was not written by M. Vauban, is its not being treated in a manner worthy of that famous engineer. It is the driest and most defective part of his book; scarce does he mention any thing touching the difficulties that are to be surmounted, in order to become master of those towers. Yet it is very certain, that if they were defended with bravery and skill, the taking of them would cost the besiegers a great deal of time and much effusion of blood. Now who could speak of them with greater dignity and judgment than their illustrious inventor? It cannot be said that he did not chuse to write down all he thought concerning the manner of attacking them, lest the enemies of his country should benefit thereby; for he never dreamt that his Memoirs would be made public. In his epistle dedicatory to the Duke of Burgundy, he affirms that he drew up those papers entirely for the use of that Prince, and that it will be proper to prevent the taking any copies of his work, lest they should be communicated to the enemy. Tho' his intention in this respect was not complied with, for particular reasons which it is of no use to make public; yet we ought to conclude, that if he had treated of the attack of tower-bastions, he would have exhausted the subject. The more he would have shewn the difficulty of taking this out-work, the more he would have proved its excellency and use. Be that as it will, this may be taken, if you please, for no more than a bare conjecture founded on the great capacity of M. Vauban. The matter will be cleared up when Count Daunoi, Marshal Vauban's nephew, publishes his uncle's Memoirs from a manuscript in his possession, which in all probability is far more correct than
that

that printed in Holland, and which will doubtless be purged of all foreign additions.

Hitherto we have supposed that the place was built on an even ground; but as there are many that have not such a situation, it remains now for us to make some general remarks, in order to give an idea of what ought chiefly to be observed in the attack of places variously situated.



XXIX.

Attack of a place situated on uneven ground.

IF all places were built on a smooth even ground, the attacking them would require no extraordinary degree of genius; the practice of the rules laid down by M. Vauban, and of which we have given a detail, would be very easy. Even with an indifferent capacity the strongest places might be taken; but these rules, so easy to follow on level ground, are liable to very great difficulties if a town is surrounded with an impracticable morass, or situated near a great river, or upon a hill of difficult access, having only a narrow spot of ground before it, without any convenient place for erecting ricochet batteries on the produced faces of the works attacked, and to make the parallels, &c.

It is in situations like these that an engineer must have recourse to his own genius, improved by experience, to obviate the inconveniencies that may arise from the inequality of ground. As for books, they can give only a few general ideas of this sort of attacks; and this is what we intend to do in the following articles, where we shall take notice of the most usual inequalities of ground.

XXX.

Attack of a place surrounded with a morass.

A PLACE surrounded on all sides with a morass, so as to be approached only by a causeway, is a situation extremely unfavourable to the besiegers.

The first thing to be done is to try to drain the marshes, and whether the water may not be turned into some other chanel, which is sometimes easy enough in a level country. But if this is impracticable, the trenches must be carried on along the causeway, widening them as much as possible, and making proper spaces for the planting of batteries.

If, on the one hand, the ground will not admit of the usual parallels or places of arms; on the other, these works are of less service here, than on a ground of easy access, because the enemy cannot fall out in a large body to fall upon the workmen.

The causeways may happen to be raised but very little, and only above the level of the water; or they may be raised two or three feet. If they are of the former sort, they cannot furnish a sufficient quantity of earth for making the trenches; and in that case recourse must be had to fascines, wool-packs, sand-bags, &c. But if they are of the latter sort, they may furnish a sufficient quantity of earth for the trenches, taking care to make them somewhat wider than usual, in order to have earth enough for raising the parapet, without being obliged, for that purpose, to dig so low as the level of the water.

Another thing worthy of attention in these causeways, is whether they are enfiladed by the works of the place; in which case it will be extremely difficult for the besiegers to lodge themselves there, or to make any turnings or zig-zags, because these would be all enfiladed likewise.

To obviate so great an inconveniency is an arduous task. Besides, if on these causeways there are no places

to be found for erecting ricochet batteries, it will be extremely difficult to form the siege.

If, notwithstanding all these difficulties, the siege of such a place be resolved on, a foundation may be made with fascines, and covered on both sides with good gabions, sand-bags, &c. and the work carried on along the causeway with frequent traverses. The 2d figure of the 16th plate will give an idea of this work, which was made use of at the siege of Bois-le-Duc in 1629. But at that time they were not so well skilled in the art of defending places as at present, for it would be extremely difficult to support a work of this nature. Yet there are circumstances in which the impossibility of doing better ought to engage us to make use of all sorts of means, in order to obtain our ends. It is in a situation like this, that an engineer has occasion to exercise his utmost skill and ability. If the causeways are six or seven fathoms broad, and five or six feet above the level of the water, if they are not enfiladed by the place, and if at proper distances they contain fit spaces for erecting *ricochet* batteries, the place may be taken, though not so easily as if it was situated on even ground. But if all these circumstances do not join, the attack will be next to impossible: in that case it will be proper to reduce such a place by blockade; this indeed may be very tedious, where a town has plenty of provisions and ammunition; but after all there is no other way of reducing it.

If, on the one hand, this marshy situation renders it impracticable to lay siege to a place; on the other it must be allowed, that this is also a circumstance greatly prejudicial to the health of the garrison and the inhabitants. However, there are very few places so entirely surrounded with morasses, but that some part or other about them may be proper for approaches; and then the attack towards the morass should be avoided as much as possible. Though the other fronts are generally better fortified, yet it is more adviseable to make the attack on that side; for the facility of carrying on the

the approaches will be more than an equivalent to the additional strength of the fortification. When the morasses are really impracticable, the place has no occasion to be so strongly fortified in that part, as where it is more accessible; but sometimes it shall happen that morasses thought to be impassable, are not really such; and upon receiving certain intelligence of this circumstance, the besiegers will avail themselves of the security of the enemy to attack the place on that side, and so to make themselves masters thereof with less expence of time and lives. It is the business of those who have the conducting of this sort of enterprises, to examine thoroughly the ground before the attack is resolved upon. Besides, there are morasses impassable at one time, that are not such at another, especially after a great drought. There may be peasants in the neighbourhood who are acquainted with this circumstance, and no pains whatever ought to be spared, in order to get a thorough knowledge of the soil and the nature of those morasses. It is obvious, that the fittest time to lay siege to a place situated in a marshy ground, is towards the beginning of autumn, when the summer heats have, in great measure, dried up the waters.

XXXI.

Attack of a place situated near a great river.

PLACES situated near great rivers, are much easier to take than those surrounded by morasses. Their approaches are made as usual, on the side most convenient; and disposed in such a manner, that batteries may be erected on the other side of the river, or in the islands which the river may form over-against the place; these batteries are to protect the trenches, and sometimes may be able to breach the front against which the besiegers direct their attack.

tack. Such was the use which M. Vauban made thereof, at the siege of Old Brisac in 1703. He erected a battery in one of the islands formed by the Rhine over-against that town, called the *Isle of Cadets*, from whence was discovered a bastion extending along the river, the foot of which might be battered in breach; by this proceeding he greatly accelerated the taking of the place, which surrendered the 14th day, from the opening of the trenches.

At the siege of *Fort Kiel*, in 1733, batteries were also erected in an island of the Rhine, which batteries breached the horn-work attacked, as likewise the face of the bastion behind the horn-work. These same batteries fired *à ricochet* upon the face and the covert-way of that bastion, which defended the branch of the horn-work next the Rhine; by which means the trenches betwixt this branch and the Rhine were greatly advanced, and the fort obliged to capitulate much sooner.

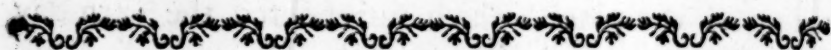
At the siege of Philipsburg in 1734, the French took Fort St. Michael on the opposite side of the Rhine*, and erected *ricochet* batteries, which enfiladed the defences of the front attacked, and thereby prevented the enemy from making all the fire they might otherwise have done, were it not for these batteries which plunged into their defences.

When there is a bridge over the river opposite the town, it is generally covered either by a horn-work, or half-moon, &c. and as in that case it is of consequence to take this outwork, batteries may be placed near the river, so as to destroy or break down the bridge; by which means the enemy, finding it extremely difficult to keep up the communication between that outwork and the town, will find themselves obliged to abandon it.

It is an observation of importance in the siege of towns situated near rivers, to know at what time they

* See Plates III. and XVII.

are subject to overflow, and the extent of their greatest inundation, in order not only to secure the trenches from any accident, but likewise to place the park of artillery in some safe position, so that the inundation shall not reach it, and spoil the stores designed for the siege.



XXXII.

The attack of a place situated on a hill.

A PLACE situated on a hill, with a very high front, and opposite to a narrow spot of ground, without any conveniency for erecting *ricochet* batteries, is extremely difficult to take.

In such a case it must be observed, whether there is not some hill or rising ground in the neighbourhood, proper for erecting *ricochet* batteries. If no such spot is to be found, the works must be battered in front, and the enemy are to be driven from thence by shells, with which the defences must be continually plied. In regard to the disposition of the trenches and parallels, they ought to follow the nature of the ground, and be disposed in the best manner possible, for producing the effects intended on even ground.

Here we must observe, that very high places, which can be battered only from low grounds, are in some measure out of the reach of the *ricochet* batteries; because the *ricochet* firing will not carry a ball farther than a certain height, as 12 or 15 fathoms. In a greater elevation the cannon must be pointed so high, that the carriage will not be able to bear it: and if to ease it the charge is diminished, it will follow that the ball will not have a sufficient force to reach the place intended.

We must likewise observe, that when trenches are to be made in rising grounds, all possible expedition must be used to get to the upper part of the hill; because

because otherwise the advantage of the situation would not only enable the enemy to make sallies with success, but likewise to plunge into the trenches, which must render the supporting them very difficult and dangerous.

Places situated on hills are sometimes surrounded with hard stony lands that have little or no earth to cover them. Here it is extremely difficult to open trenches; and there is no other way but to make them of wool-packs, sand-bags, and other materials, to supply the place of earth. It often happens that these places are cut in a rock, and then the fixing the miners is extremely tedious and difficult. In that case the rock must be examined, to know whether there are no veins softer than the rest, and through which the workmen may pierce their way more easily.

Under these different circumstances the besiegers must arm themselves with patience, and by perseverance they may surmount all the difficulties of the soil. M. Goulon, in his *Memoirs*, proposes making the descent into the ditch, by a hole pierced near the counterscarp as deep as possible. He supposes a ditch 30 feet deep, and the miners, by being often relieved, may pierce a hole about six or seven feet, in seven or eight days; after which two mines are to be made, one to the right and another to the left of this kind of wells, disposed in such a manner as to produce their effect in the ditch. Before they are sprung, a great quantity of sand-bags, fascines, &c. ought to be thrown into the ditch, to begin to fill it up. The mines blowing up after this, the rubbish they make will cover these fascines and sand-bags, and fill up part of the ditch. Thus by continuing to spring the mines, an easy descent may be effected at last.

To breach a rampart cut in a rock, the same M. Goulon proposes to erect a battery of seven or eight pieces of cannon, in order to play upon the wall where the rock ends and the masonry begins, and from thence upwards, that the rubbish and the earth together

together may form a slope easy enough to mount the breach. If it is necessary to widen the breach, in order to render it more practicable, the miners may be directed to work into the rubbish made by the cannon, and to place some mines there, which, when sprung, will certainly enlarge the breach to a sufficient width.

No doubt but a great deal more might be said, in regard to all these articles; but for the particulars, we refer the reader to the Memoirs of M. de Vauban, which display the whole extent of genius of that great man, and shew how capable he was of finding out expedients, for surmounting all obstacles, arising either from soil, situation, or different manners of fortifying.

XX

XXXIII.

Attack of a maritime town.

A Maritime town, that has a harbour, is pretty much in the same case with other towns, when the besiegers are masters at sea, so as to block up that harbour, and hinder the place from being relieved that way. If the sea is open, or even if a few vessels or boats can steal into the harbour, the place, by receiving continual supplies, may hold out a long time. Ostend maintained a three years siege against the Spaniards, and so long a defence was owing to its being supplied continually, with all necessaries, by sea.

Therefore the siege of this sort of places ought not to be undertaken, except when the besiegers are in a condition to block up the harbour, and by that means to prevent the town from receiving relief.

It is not sufficient for this purpose, to have a numerous fleet before the harbour, because the enemy may watch the opportunity of a dark night, to pass by the fleet unperceived, with small boats full of ammunition and provisions. The most effectual way to hinder these succours, would be, if the situation permitted, to raise a dyke,

a dyke, or stockade, across the harbour, like that made by cardinal Richelieu, to stop up the entrance of Rochelle. But not to mention that there are few situations which admit of a work of that kind, it must be so difficult and tedious to execute, that it cannot be proposed as a measure to be adopted, in the attack of all maritime towns. Instead therefore of so great and laborious an undertaking, what the besiegers must do, is to watch with all diligence, in order to prevent, as much as possible, any boat or ship from entering the harbour. This being strictly observed, the approaches by land are carried on in the usual manner; for the vicinity of the sea makes no alteration in that respect: so far from it, the ships firing against different parts of the fortifications, may favour the progress of the attacks.

Sometimes maritime towns are bombarded, without any design to lay siege to them, because it would be attended with too great difficulty. This method is taken to punish towns that have given just reason to complain of their behaviour, as Lewis XIV. did, in regard to Algiers, Tripoly, Genoa, &c.

These bombardments are made with ships built on purpose, for containing the mortars, and for this very reason are called *bomb-ketches*. They were invented by chevalier Renau, in 1680, for the bombarding of Algiers. "Hitherto, says M. de Fontenelle, in his elo-
"gium, no one ever imagined, that mortars could be
"used any otherwise than on land, or without a
"solid base." Yet M. Renau proposed bomb-ketches, and they had all the success he expected. The shells he fired from on board those vessels, made such havoc in the town, as obliged the Algerines to sue for peace.

XXXIV.

To prevent succours from being thrown into a town besieged.

NOT to interrupt the thread of the usual operations of a siege, we have supposed that the general had taken every necessary measure to guard against all the attempts of the enemy, and to secure success by the great superiority of his forces. Sometimes however it may happen, that an enemy who were looked upon as too weak to relieve the place, shall prepare to attack the army of the besiegers, either in consequence of drawing out most of the troops from the neighbouring garrisons, which are least exposed, or of having been reinforced from some other part. In such case, there are two ways to follow: the first is, to wait for the enemy in the lines, and to hinder them from breaking through; the second, to leave part of the army in the lines, in order to carry on the siege, and to oppose any sallies of the garrison; with the other to go and meet the enemy, and fight them out of the lines.

Both these ways are supported by the opinion of different generals; but the latter seems to have the most general approbation.

The inconveniency of waiting for the enemy in the lines, is the uncertainty on which side he intends to direct the attack; for which reason the besiegers are obliged to be equally strong in all their posts; and when the line is very extensive, the troops are at too great a distance from one another, to make any considerable resistance on the side where the enemy forms his attack. Most lines of circumvallation, that were ever attacked, have been forced; so that both reason and experience seem to establish it as a maxim, that it is preferable to go and meet the enemy, and not to let him come within reach of the lines.

Without pretending however to determine so important a matter, it seems, that when a line is not very extensive, it may be defended to an advantage. And, first of

of all, it is beyond all doubt, that if the troops, behind the line, know how to avail themselves of the several circumstances in their favour, their situation is, in many respects, preferable to that of the assailants. The latter are exposed to the fire of the line, for a very considerable time, before they can come up to the border of the ditch. This ditch must be filled up; and all the while they are exposed to the same fire, which must kill a great many of their men, and throw their troops into some confusion. And when they break into the line, they can make but a very narrow front; for which reason, they may be charged both in front and flank, by the troops within, who, if they do their duty, must drive them into the ditch. For, suppose the first line of the defendants infantry, next the ditch, should be obliged to give way; the horse, that are behind them, may and ought to fall upon the enemy's foot, that have pierced through the line; and as the latter cannot force their way but in some confusion, the former may easily drive them out again. Notwithstanding such evident advantages in intrenchments, experience, says a famous military writer*, plainly shews, that troops are less brave and resolute behind an intrenchment, than in the open field. For they place their whole confidence in this defence; so that when the enemy, to avoid being exposed too long to the fire of the line, jumps boldly into the ditch, and endeavours to mount the intrenchment, the soldier begins to lose his confidence, but loses it intirely, as soon as he sees that the enemy breaks through the line. "He looks upon the evil, says this author, as past relief, when there is nothing easier than to remedy it, by forcing the enemy back again, and tumbling them into the ditch. For, not to mention that they cannot pierce through in good order, they have spent their whole fire. Yet, continues the same author, nothing of all this is done; the enemy enter pell-mell, and form their

* The chevalier Folard.

“ranks while the others retire; the terror spreads along the line, they all betake themselves to flight, and disperse, without knowing in what manner the enemy forced their way.” Upon the whole, we may conclude, that if the troops are sensible of the many advantages of a good line, and are determined to defend it; if the several parts are likewise well supported, and all the necessary precautions have been taken to prevent being surprized, it will be extremely difficult for the enemy to force it.

Of this we saw an instance at the siege of Philipsburg, in 1734. Prince Eugene reconnoitred our lines of circumvallation, and found them so well disposed, that he never once attacked them. He was obliged to act merely as spectator of the siege, and did not judge proper, says the writer of his life, to attempt to force our lines; so formidable did they appear, and so secure from all insult. And indeed, from the smallness of their extent, the army of the besiegers were enabled to support equally every part. They formed a kind of irregular semi-circle round the place, of which the Rhine might be considered as the diameter. They were defended by a kind of fore-ditch, and by wells between this fore-ditch and the lines, as may be seen Plates III. and IV. If the enemy had attempted to pass over this ditch and these wells, they would have lost a great number of men by the fire of the lines. The wells were so near to one another, that there was no possibility of passing between them: they must have been filled up, as well as the fore-ditch, with fascines. This would have been so tedious and dangerous an enterprize, as must have certainly discouraged the enemy's troops: and supposing they could have got near the lines, it is almost demonstrable, that in the condition they must then have been in, they could never have withstood the bravery of the besieging army.

This reasoning seems to be more convincing, as we may presume that prince Eugene reasoned just in the same manner himself: for since he did not think proper

to attempt to force the lines, it is natural to conclude from thence, that he saw no probability of succeeding.

In such a situation therefore, the besiegers may wait quietly in their lines; but if they should be of so great an extent, as not to admit of being equally guarded, then it seems to be the safest way to draw out the troops, and meet the enemy, as marshal Tallard did at Landau, in 1703. After he had defeated the army which was marching to the relief of the place, he returned and finished the siege. The duke of Vendome acted just in the same manner, at the siege of Barcellona, in 1697. Having had intelligence that the marquis of Velasco, viceroy of Catalonia, was preparing to attack him, he went out to meet that general, gained a complete victory, and returned afterwards before the place, which was obliged to capitulate. Every body knows, that at the siege of Turin, in 1706, the late duke of Orleans proposed taking the same step, and that the consequence of rejecting his advice, was, that the French army was obliged to raise the siege; for as the lines were not equally strong in every part, the enemy penetrated through a post that had been neglected, so that the troops were forced, and the town was relieved.

The chevalier Folard pretends, that without going to meet the enemy, it would have been an easy matter to prevent them from forcing the lines, had proper care been taken to support them. That for this purpose, a sufficient body of troops should have been sent to defend that part which prince Eugene attacked; that here the lines were good for nothing; that there was only the brigade *de la vieille marine* to defend them, and notwithstanding that they were only two deep, yet in this weak situation they repulsed the enemy. But it happened during the attack, that prince Eugene having observed a part of the lines to the right, where there was only a single company of grenadiers; and that there was a possibility of coming at this part, under cover of a *rideau*, or rising ground, while he cut out work for the troops on the right; he sent fifty men

to try what they could do, and these forced their passage: that at first it was imagined a much greater number had entered; and that as soon as the enemy carried this post, which was too weakly guarded to make any resistance, the terror spread on every side, and obliged the French to abandon the lines. This same author adds, that if M. d'Albergotti had sent a strong reinforcement, which was in his power, to the abovementioned post, prince Eugene's attempt would have certainly miscarried. Thus the example of the siege of Turin, properly understood and explained, does not in the least prove, that lines, well defended and supported, are always forced of course. It proves only, that when there has been some neglect in the circumvallation, when it is not equally strong on every side, and when the enemy have time to force some part of it before the others can send proper succours, it is not advisable to wait there to be attacked; but that it may be done, when the lines are in a good state of defence, as were those of Philipsburg.

Notwithstanding all this, we must allow that the safest way to conduct a siege, is to have a good army of observation advantageously posted, so that the enemy shall not be able to oblige them to fight, without exposing themselves to a very great risk, and thereby to cover the siege, and near enough to receive succours from the troops employed before the town, should the enemy come to a resolution of giving battle.

Thus it was that Lewis XIV. acted in all the sieges he made in person, and which always turned out successful.

If the enemy do not think proper to attack the besieging army, they may probably try to throw in some small succours of troops and ammunition into the town. The way to prevent them is to make the circumvallation very exact, and not to leave an opening in it, under any pretext whatsoever.

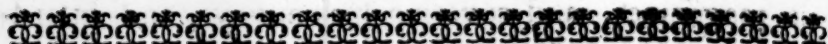
The enemy may likewise attempt the raising of the siege, by making themselves masters of the spot, or place,

place, from whence the besiegers draw their provisions and ammunition. And thus it was that marshal Villars obliged prince Eugene to raise the siege of Landrecy. But before a general lays siege to a town, he should take all the necessary precautions, for securing his magazines, and covering his convoys, and guarding the several posts, through which the enemy might march to attack him.

He ought to put himself in the enemy's place, in order to see what he should do himself in the like case; he ought also to take all the necessary measures for covering his magazines, and protecting them against any hostile enterprize.

Another expedient the enemy may think of for raising the siege, is to attack some place of importance, which the besiegers have an interest in preserving; in order to engage them to march to its assistance, and to abandon the siege they have in hand. But this expedient ought to have been foreseen, and should not cause the raising of the siege. It is natural for a general, before he thinks of laying siege to a place, to begin with taking all the precautions which prudence and military skill can suggest, for preserving his own country, and covering it against any attack of the enemy. They cannot but think of indemnifying themselves, if possible, for the loss of any place you take from them, by taking some of yours; therefore, as every attempt of theirs must naturally be foreseen, a general should guard against it. However, should the enemy find means to engage in an enterprize of importance, and which requires an immediate relief, if a general thinks there is not time sufficient to take the place he has laid siege to, and at the same time to oppose the enemy's designs, in that case he may raise the siege; but for so doing, there should be very cogent reasons. When king William laid siege to Namur, in 1695, marshal Villeroy, in order to divert him from his purpose, fate down before Brussels, thinking he should oblige that prince to march to its relief, and abandon his enterprize against

Namur; but king William chose rather to suffer that city to be bombarded, than to relinquish a very important conquest, in which he was in a manner sure of succeeding.



XXXV.

Of the raising a siege.

WE shall be very concise upon this disagreeable operation, but we cannot avoid mentioning a word or two about it, after having treated of throwing succours into a town.

Suppose that, by some one circumstance of those related in the preceding article, or through some other cause, a general finds himself reduced to the melancholy necessity of abandoning the siege; in that case, if he apprehends being incommoded by the garrison in his retreat, he ought carefully to conceal his design from them. First of all, the guns and mortars are to be drawn off betimes, from their batteries: then the implements are carefully collected, and put into the waggons; and if he intends to steal away unknown to the enemy, all the artillery and baggage must set out at the beginning of the night, the trenches and the places of arms being still filled with troops, who are to continue firing, in order to deceive the enemy; and when the baggage is pretty far removed from the place, all the troops are to follow, while the fires in the camp are left burning as usual. The whole is to be escorted by horse or foot, according to the country in which the retreat is made, whether through open plains or inclosures. Sometimes it may happen, that a general shall be forced to retire in a hurry, without being able to take all his baggage with him; in such case, whatever he is obliged to leave, must be previously burnt and spoilt, that it may be of no use to the enemy, &c.

When

When an army is in no danger of being pursued by the garrison, in its retreat, the artillery and baggage are sent off by day, and the troops march after them.



XXXVI.

Of the attack of small towns, castles, &c.

ALL that has been hitherto said, relates to the besieging of places regularly fortified, and of some importance. But in the course of a war, it often happens, that there are small towns, which serve to guard a pass necessary to be taken; or there may be small castles, not worth the attention of an army, and which a few officers may be sent to seize upon, with proper detachments, according to the importance of the posts. Some observations, touching the manner of behaving in this sort of attacks, will not perhaps be without its use to young officers, for whose sake this work is written, and who may be employed in the undertaking.

Most of these towns and castles are no otherwise fortified, than by a single wall without a rampart. At the most they may happen to have a paultry ditch round them, of easy passage; and some little works, fraised and palisaded, opposite to the the gate, to cover the place from any sudden insult.

How weak soever the wall of such a place may be, still it would be running an evident risk, to appear before it in open day, and to attempt to mount it, in order to become masters of the castle or town.

If the enemy are men of courage and resolution, they will be surely sensible of the difficulty there must be in getting over their wall, and breaking their gates, in order to force a way into the town.

The method therefore of attacking these weak places, is to make a breach in the wall; and for this purpose,

a detachment must be sent, with some small field-pieces, and two mortars of seven or eight inches diameter, and set out time enough to arrive before the place about dusk ; immediately an épaulement is made to cover the troops, guns, and mortars ; and at break of day they begin to fire briskly upon the enemy, which is the only way to oblige them to surrender expeditiously, and without much loss.

But if guns and mortars cannot conveniently be had, the safest and easiest method then, supposing you are well acquainted with the place, is to try to take it by scalade. A false attack may be made on one side, with a view to draw the attention of the enemy that way ; and on the other side, the ladders may be applied, in order to mount the wall, and to penetrate into the town. If the scalade succeeds, they who have got in, must immediately open the gates for the rest of the troops. Then they must fall suddenly upon the garrison, who are defending themselves against the false attack, and seize on every thing that can facilitate the taking of the place, and oblige the enemy to surrender.

In this sort of attack, petards are often of great use, for breaking open the gates, and penetrating into a town. Above all, surprize is requisite in these cases, being the surest way of attacking the enemy with success, and with the least loss. We find in Feuquiere's Memoirs, several examples of posts of this sort that were forced ; and the same method may be followed on the like occasions. We shall not give these examples here, because it is proper that young officers should read those Memoirs, which were written by a man perfectly skilled in the several branches of the military art, and who had greatly profited by the lessons of those excellent generals under whom he served.

There is one sure way of driving the enemy from any little posts, which they do not chuse to abandon, and which it may be difficult to force sword in hand ; this is, to set fire to them. The remedy is indeed somewhat

what violent, but the laws of war allow it; and it should be put in practice, whenever it is found necessary for the preservation of the troops under a general's command.

Of whatever nature these small places may be, if they cannot be taken by surprize, recourse must be had to force; some infantry must be placed in such a manner, as to fire continually at the enemy, wherever they appear; in the mean time, the gate must be either forced open with a petard, or cut with hatchets; and for the security of those employed in this dangerous undertaking, a very brisk firing must be made, all the while, against the enemy. When the gate is broke open, if there are any barricades behind, they must be forced, by making a very sudden attack, and not giving the enemy time to recover their surprize; so that they must surrender prisoners of war, after they have defended themselves to the last extremity, and when it is impossible for them to hold out any longer.

XXXVII.

Of the surprizing large places.

FORTIFIED towns, where military discipline is strictly observed, are in little danger of being surprized; but however it may happen, and indeed it has happened, that a neglect of discipline shall encourage an enemy to attempt to take a place by surprize.

A complete detail of whatever relates to surprizes, would carry us too far; and we shall only observe, what is most generally practised with probability of success.

Every surprize being particularly founded on the neglect of military discipline, a general ought therefore to be exactly informed of the state thereof in the town, and

and of the character of the officer who commands there: he ought also to have a thorough knowledge of the number of troops in garrison; and of the guard-rooms, and posts of most importance in the town, that he may seize them first; he should likewise be informed of the nature of the ground about the place, to the end that the troops may approach undiscovered. All this intelligence he may receive from some person or other, belonging to the garrison, by dint of money, or by sending an able officer to reside there for some time, under some pretext to avoid giving umbrage. It is always dangerous to trust any of the town's people, because they may happen to communicate the project to the commanding officer: and then they will draw a general into a snare, by so tempting a bait as the surprizing of the town. Therefore he should be cautious who he confides in, and at all events should make sure of the conductor of the enterprize.

All these things being known, the next point is to examine which is the best way of getting into the town, whether by a common-fewer, as was done at Cremona, or by some other passage which the enemy may happen to have neglected; or by introducing officers and foldiers, in the disguise of peasants, merchants, women, &c. who are to fall upon the guard at the gate, and disarm them; then to make the troops without the town approach, and take possession of the gate, and afterwards of the several posts of importance in the place; or last of all, by making a number of officers and foldiers enter the town in disguise, where they are to conceal themselves in the house of some private person, bribed to receive them; and in the night time, to kill the centinels, after which they are to surprize the guards, to break open the gate, to let down the draw-bridges, and to introduce the troops. Beside these, which are the usual means or stratagems, and which have been often put in practice, others may be imagined according to occurrences, and as the na-

ture of the ground shall suggest. Supposing that every disposition has been made to enter the town, and that the scheme has succeeded one way or other, the troops should be sent to secure the ramparts, and to prevent the garrison from making use of their cannon. They should also seize on the caserns, lest the garrison should assemble together, and make one general effort to recover the town. If the habitations of the commanding officers are known, it will be proper to secure them, so that the garrison finding themselves without a head, will not be so well able to defend themselves. Lastly, if there should be a castle or citadel within the town, care must be taken, by cutting off the passage, that the garrison do not throw themselves into it; and indeed every endeavour is to be used, in order to reduce it as soon as possible, otherwise the success of the enterprize would be extremely precarious. Such are in general the cautions to be used in these undertakings: they are of the same nature as those which are practised upon taking a place by scalade: an operation which forms the subject matter of the following article.



XXXVIII.

Of the taking a place by scalade.

THE manner of taking a place by mounting the wall with ladders, which is what we call scalading, was a great deal more common before the invention of gunpowder than at present; therefore the ancients used to take the greatest precautions against it. Their walls were not terrassed, and moreover they were very high; so that there was not only occasion for ladders to mount, but likewise to descend into the town.

The

The towers were much higher than the wall, by which it was flanked; and the walk or space within the wall, on which were placed the soldiers who defended the town, was cut opposite to those towers; so that the enemy, even after getting to the top of the wall, were still far from being masters of the town. And yet, notwithstanding these difficulties, escalades in those days were frequent. Probably the great length of time, requisite for making a breach in a town-wall, was the cause of their having recourse to this method; but as cannon will make an opening pretty quick, the custom of escalading has been insensibly disused.

Perhaps the construction of our modern fortifications has been partly the cause of this change. The ancients having no outworks, an enemy might immediately come up to the border of the ditch, descend into it, and fix the ladders to the wall. Our outworks do not admit of so easy an access to the body of the place. Yet when the ditch is dry, as must generally be the case in escalades, it would not be impossible, if the place had no other outworks than half-moons and a covert-way; it would not, I say, be impossible to escalate it, especially if there is but a weak garrison: for this sort of enterprize can hardly ever succeed against a numerous garrison, who are able to guard and defend all their posts. But though we were to suppose it too difficult to succeed in towns fortified after the modern manner; yet in countries that are the seat of war, we find a great many towns that have only a wall terraced, and a single ditch. Against such places, the method of escalading might be employed with success, as was the case at Prague, in the month of December 1741.

To succeed, it is requisite, first of all, to have a thorough knowledge of the place; and its fortifications, in order to scale it on that side which is the safest, and most neglected by the enemy.

There must also be a great number of ladders, to the end that a body of men may mount at the same time;

time; they should have petards to break open the gates, and to give admittance to the troops that are to support the enterprize.

That the enemy may be less capable of making resistance, they must be surprized. If the garrison are upon their guard, it will be more difficult to force them, because they can easily defend themselves against a scalade, when they have timely notice of it.

But in the confusion and surprize the enemy cannot think of every thing, at least they cannot ward off every blow. They are attacked on several sides, to the end that they may divide their forces, and it is not easy for them to distinguish betwixt the real and false attacks: of course they are obliged to make an equal stand at all their posts; and while their attention is taken up on one side, the place is entered by another.

It is therefore of the utmost importance to conceal the design of such an enterprize from the enemy. For which reason, care must be taken to prevent their receiving any notice of the making of ladders necessary for the occasion; and if there should not be a sufficient number in the magazines, they must be made with the greatest secrecy.

Ladders may be so contrived as to take to pieces, that is, they may be of several joints, and these are the best for carriage. Such were those made use of at the scalade of Geneva, in 1602.

When every thing is got ready for the enterprize, and nothing further is requisite than to put it in execution, a body of men, such as may be thought sufficient on the occasion, as well horse as foot, are ordered upon the service. The horse will serve, as soon as they have gained admittance into the town, for charging and dispersing the enemy assembled in different quarters, and in favouring the retreat, if a retreat should be found necessary, and is to be made through a champaign country. It will be also proper to take
locksmiths

locksmiths and carpenters upon the expedition, in case there should be any occasion for their service.

The troops are to direct their march, so as to arrive before the town an hour or two before day; and they must take special care that the enemy receives no intelligence of their motions. If they meet any body by the way they must secure them, and arrive before the place with all possible silence. As the general ought to be informed of the road they are to take, and of the defiles they are to pass, he is consequently judge of what time they will be upon their march. To make this calculation exactly is a matter of the utmost consequence; for if the army was to make too long a march, they might arrive too late to commence the attack before day; and in that case, without a very great superiority, they would be obliged to return. Sometimes it happens, according to the situation of places, that the troops arrive before a town by different roads; and in that case the march is less tedious and embarrassing: but the officers, who have the command of each corps, ought not, upon any account whatever, to retard their march, but to take care they arrive before the place at the hour appointed, to the end that the different attacks may all begin at the same time, or at the hours agreed upon; for sometimes it is proper, especially when it happens to be a large town, to begin them successively. The first attack draws the whole attention of the enemy, who fly to that side immediately; the second obliges them to divide their attention; and when the first, which is generally a false attack, has drawn the greatest part of the garrison that way, then begins the real attack, where the enemy will make a more feeble resistance.

The ladders are brought before the place in waggon; these are preceded by the greatest part of the troops designed for the expedition, who are also preceded by some companies of grenadiers to form the vanguard.

As soon as they come before the town they draw up in order of battle, and with all the silence possible. The ladders are distributed among the soldiers, who are to commence the escalade, and ought to be the bravest and stoutest fellows in the whole corps.

The troops designed for the attack are divided into small parties, of 100 or 120 men commanded by their officers, and then they are to draw near the place. If there is a covert-way, the locksmiths are employed to break open the barriers with as little noise as possible. After the troops are got there they attempt the descent of the ditch; the soldiers that have ladders make use of them for this purpose, (upon a supposition that it is deep and has a revetement, and that they cannot slide down its slope, which is a much quicker way) and the others by the steps or stairs which are generally made in the roundings of the counterscarp and its re-entering angles.

As soon as they have descended into the ditch, they fix the ladders to the rampart or its revetement with all possible diligence; then they mount as quick as they can, without overloading the ladders. When a body of 100 or 120 men have got up, the locksmiths and carpenters are ordered to break the nearest gate. The troops, as fast as they mount, are to draw up in order, and if the enemy present themselves, they are to charge them vigorously with their bayonets fixed, but without firing, for fear of alarming the neighbouring guards. When they have got a sufficient number upon the walls, and the gate is opened to let the rest of the troops into the town, they are to disperse themselves all along the rampart in order to become entire masters of it; then they are to join the corps that has entered the gate, and to attack the enemy in whatsoever part of the town they retire to. If there was only a small number of men that mounted the walls, and the enemy were coming to attack them, in that case they must make as good a defence as they are able, by covering themselves with whatever things

things they may find upon the rampart, as with the branches of trees, if any grow there, and behind these they are to defend themselves, till such a number of men have mounted as are sufficient to charge and oppose the garrison.

Though the enemy should be exact in making their rounds, and the centry, perceiving that the troops are in the ditch and ready to mount, should fire and alarm the town, still this should not hinder the troops from mounting immediately. As there must be always some time before succours can come, this interval may be taken for scaling the walls, with numbers sufficient to make head against the troops on guard, who are the first that present themselves upon the rampart.

If there is a castle or citadel belonging to the town, situated, as is customary, in such a manner, that part thereof shall be in the town, and part in the country, you must try to scale it at the same time as you do the town, to the end that the enemy may find no retreat, but, pressed on all sides, be obliged to surrender.

So long as any part of the garrison keep together, and are in a condition to make a stand, great care should be taken to prevent the soldiers from running about to plunder. Orders ought to be given upon pain of death, that no soldier shall stir out of his rank, or enter or set fire to any of the houses. If this caution was not taken, the troops would spread themselves on every side, led by the greediness of pillage, and be in danger of being beaten in detail, and of ruining the enterprize.

When the garrison have delivered up their arms, and there is no longer any enemy to oppose, still the soldiers should be contained within bounds, to save the place from being plundered; but to make them amends in that case the town is fined a sum of money, which is afterwards distributed among the troops concerned in the enterprize.

Here

Here we have all along supposed that the ditch is dry; if it be otherwise, the town will be more difficult to take by scalade. Yet you may apply *sambucs*, a kind of boats with ladders in use among the ancients; but it is very difficult to fix them to the wall without making a noise; and, as we have already observed, there is no expecting a scalade to succeed, except when the enemy is surpris'd.

When the ditch happens to be muddy, and there is no firm treading, boards, hurdles, or fascines are thrown in, and then it may be pass'd over without sinking into the mud.

The fittest time for surprising towns that have wet ditches, is the winter, when the waters are frozen. It is an easy matter to cross the ditch by walking upon the ice, and to mount the rampart, by fixing the foot of the ladder also upon the ice. An attentive governor will therefore be sure to see that the ice in the town ditches be broke every day; but some, perhaps, will not take so much care; and besides, they who are charged with executing the orders, may do it in so slight a manner, that it may be still practicable to make use of the ice, in order to fix the ladders to the foot of the rampart, and to get over the ditch. It behoves those who attempt this sort of enterprize, carefully to watch the conduct of the governor, as well as of those whom he has entrusted with his orders, to see in what manner they are executed, and to take their measures accordingly.

Even after the troops have got into the town, it is oftentimes difficult to break open the gates. The petard, as we have already observed, ought to be used on this occasion, when there is no possibility of taking the gate off the hinges. Care is also to be taken, if there be a portcullice, to place something under it, or in its grooves, to prevent the centinel, who is generally over the gate, from letting it fall, which would increase the difficulty of the passage. If there are orgues, the best way to guard against them, is to kill the

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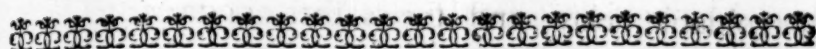
person who is to let them fall in case of a surprise; but then it is necessary to know the way to him. If there is no getting at him, and he lets the orgues drop down, there is no other remedy than to cut them to pieces with hatchets, or to saw them asunder. This is an unavoidable delay, and shews the goodness of that contrivance.

The chevalier de Ville, who descants largely upon attacking by surprise, and upon escalades, observes, with great reason, that there are a thousand accidents which may happen in the execution of this sort of undertaking, and can neither be foreseen nor described; but that the general's capacity and experience ought to find a remedy for every thing, therefore he should not be amazed when any unforeseen mischance happens, for *in doubtful cases*, says that author, *fortune administers counsel*. And indeed an able general ought to have resources within himself to guard against every accident, and to be surprised at nothing. It is a known story, that when prince Eugene was just upon the point of entering Cremona, he heard a drum beat in the town, to call a regiment together that was to be reviewed at break of day; and in answer to those who advised him to desist from his enterprize, imagining it was discovered, because they knew not the cause of beating the drum, he said, *the wine is drawn, it must be drunk*. Thus ought a general to behave in the like case, and not to let his project miscarry through ill-grounded fears. He should never desist, but when it is beyond all manner of doubt, that there is no possibility of attempting the thing without the utmost danger.

We shall finish this article, which is already too long, though a great deal more might be added before we could exhaust the subject; we shall finish it, I say, with observing that the escalade may be used even in a regular attack. When a breach is made in the bastion or in another work, and the enemy seem disposed to defend it vigorously, ladders are fixed along the wall, and the work is escaladed.

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The duke de Noailles, now marshal of France, tried this expedient with success at the last siege of Gironne. It is likewise known that he made use of the escalade in 1710, to recover Certe from the English.



XXXIX.

In what case and in what manner a siege may be accelerated.

AFTER having treated of the principal ways of surprising a town, nothing more remains, than to give some idea of the manner of accelerating a siege, which can be effected only by a kind of surprise.

Before a resolution can be taken to accelerate a siege, a general must be sure that the garrison is but small, or that the place is defended by the inhabitants only; that the defences are in a bad condition; if there are outworks, that they have been let to run to decay; in short, he must be sure that the weakness of the garrison, and the bad state of the fortifications, will not permit the enemy to withstand a sudden and accelerated attack, by which the besiegers intend to make themselves masters of all the outworks. Hence it is evident, that it must be very difficult to accelerate the siege of a place, whose fortifications are in good condition, and the garrison vigilant and careful. Nothing but secrecy and surprise can give success to this sort of enterprize.

Suppose a general has taken all the precautions necessary for promising himself success in an attack of this nature, the manner of conducting himself therein, according to M. Vauban, is as follows.

First of all a considerable quantity of materials and tools are got ready; as pick-axes, iron shovels, hatchets, and a number of ladders of light wood, proper for scaling the outworks within reach, &c.

When this is done, on the night for commencing the attack the troops and necessary workmen are ranged in order. It is proper to observe, that to facilitate the undertaking the trenches may be opened as usual a day or two before, towards that side of the place which seems the easiest, in order to draw the whole attention of the enemy that way, and to prepare for the assault on the side opposite to this opening.

The troops designed for making the attack ought to be divided into several lines, composed each of different corps, grenadiers and workmen, and disposed in such a manner as to be able to support each other, as well as to protect the workmen, who ought also to be ranged in different corps, and to be provided with all the tools they may possibly have occasion for.

The soldiers of the first detachment ought to have no more than their arms, with a few hatchets to cut the palisades. The troops immediately next to them ought, over and above their arms, to have each man a double fascine, that is, one bigger than usual, and a picquet to fasten it when it is laid down for a lodgment. They should likewise be intermixed with platoons of workmen; and there ought to be a sufficient number of brigades, to be able to execute the several operations intended.

These dispositions being all made, the besiegers advance softly towards the glacis. Before they commence the attack it will be proper to *halt*, that the troops may have time to breathe; which will be so much the more necessary, as they may have marched, perhaps, a considerable way, and a little rest will enable them to charge the enemy with more spirit and vigour. At length, when they are just near the glacis, the signal, as agreed upon, is made for all the troops to attack the covert-way together; immediately they advance to the palisades and endeavour to break them down, in order to enter the covert-way, and to drive away the enemy. The attack is bent chiefly against the

the salient angles of the covert-way, and from thence the troops extend themselves on both sides, to gain the places of arms of the re-entering angles. As soon as the enemy are driven from thence, the workmen should endeavour to make a lodgment in the upper part of the glacis; for which purpose they must use their fascines, which are to be laid horizontally, and fastened together with picquets. In order to expedite this lodgment, they may make use of chandeliers and great bundles of fascines, like those which M. de Folard mentions in his Commentary on Polybius, for filling the ditch before the lines. They may be constructed in such a manner, as to be tied strong together. By means of such bundles, a lodgment would soon be covered from the fire of the place. They may likewise serve another purpose, namely, to cover the troops that support the workmen; for they have only to put one knee to the ground behind the bundles, and there is hardly any danger of their being incommoded by the enemy's fire.

While the lodgments are making, the troops that support the workmen must keep continually firing against the enemy's defences. As the assailants are far more numerous than the garrison, they have it in their power, by the superiority of their fire, to silence that of the enemy, or at least to diminish its vivacity, and to render it less dangerous.

As the lodgment on the covert-way, though made in the best manner, would be unable to withstand the garrison the day after the attack, unless it were supported by other works; for this reason, at the same time that this lodgment is making, parallels must be also constructed within a proper distance to support it, and there should be communications made for all these parallels. If the works are carried on with the utmost diligence, and with the number of hands presumed to be requisite to finish them in one night, the next day the besiegers will find themselves nearly in the same situation, as they would be in trenches the day after their

their being opened; that is, they will be covered from the fire of the place, and by relieving the workmen and troops of the night, the works will soon be brought to their proper degree of perfection.

If it is impossible to establish the communications the first night, it must be done the second or third; but it is absolutely necessary to have a good parallel within reach of the glacis and of the covert-way, in order to support the lodgments erected there.

By this proceeding the siege of a place is considerably advanced; inasmuch as the second or third day of the attack, the besiegers are able to erect batteries on the head of the glacis: but, as we have already observed, there is no possibility of acting in this manner, unless the garrison be weak and the fortifications in a bad condition.

If there happen to be any horn-works, half-moons, &c. that may be insulted at the same time as the covert-way, it will be proper to scale them; and if they are fraized, to cut a way through with hatchets. No doubt but it is more difficult to take these than the covert-way; but on the other hand it is very advantageous to take them, especially the horn-works; because as the ditch before them is not seen from the place, it affords a cover to a great number of men, and all sorts of materials and necessaries may be collected there for carrying on the attack. To be able to take these works, there must be a dry ditch. If it be filled with water, the undertaking is attended with more difficulties; and in that case there is hardly any possibility of stopping, till the taking of the covert-way. These irregular attacks are very rare, because a great many things must concur to their success.

And yet there are many occasions on which they may be tried, as when the season does not admit of a siege in form; when there is intelligence that the enemy are upon their march to relieve the town; in fine, when it is of the utmost consequence for the besiegers to make themselves masters of the place with

all expedition ; and when, from the nature of the fortifications, as well as from the number of the garrison, there is reason to presume, that upon taking all the precautions requisite, the enemy will not be able to withstand an attack of this kind. But to succeed with more ease, the besieged must by all means be surpris'd, pushed hard, and allowed no time to recover themselves.

We shall finish here the subject of attack ; it remains now for us to give a short account of what relates to the defence of places ; which we intend to do in the next treatise. No mention has been made as yet of capitulations ; this subject more naturally belonging to the treatise of defence.

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